DECEMBER 1956

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

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Gage Care . p. 67 · Automatic Welding . p. 71 · $'s for Modernization . p. 138
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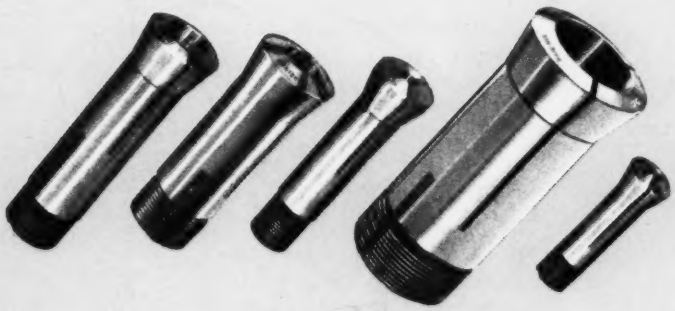
for
LATHES AND MILLERS



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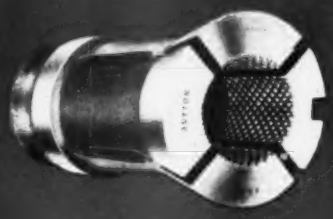

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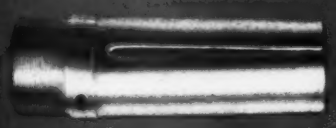

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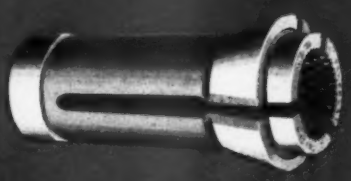

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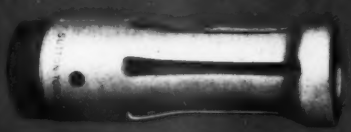

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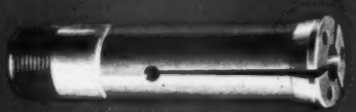

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TOOLING and PRODUCTION

The Magazine of Manufacturing Management

Published Monthly by Huebner Publications, Inc.

Formerly Tool-Die-Machine PROGRESS 1934-1941
TOOL & DIE JOURNAL 1941-1951

VOL. XXII—No. 9
DECEMBER 1956

GEORGE J. HUEBNER, Founder

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Editorial ..... Page 61

TOOLING and PRODUCTION'S great appeal is to those men who operate the plants and divisions of industry, their production departments and their toolrooms. It is they who collectively are charged with the responsibility of manufacturing their companies' products precisely, efficiently and profitably.

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Accepted as Controlled Circulation Publication at Louisville, Ky.

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HUEBNER PUBLICATIONS, INC.

Editorial and Business Offices:
1975 Lee Road, Cleveland 18, Ohio
FAirmount 1-4040

Ship plates ONLY to:
Printing Office
112 E. Chestnut Street
Louisville 2, Ky.

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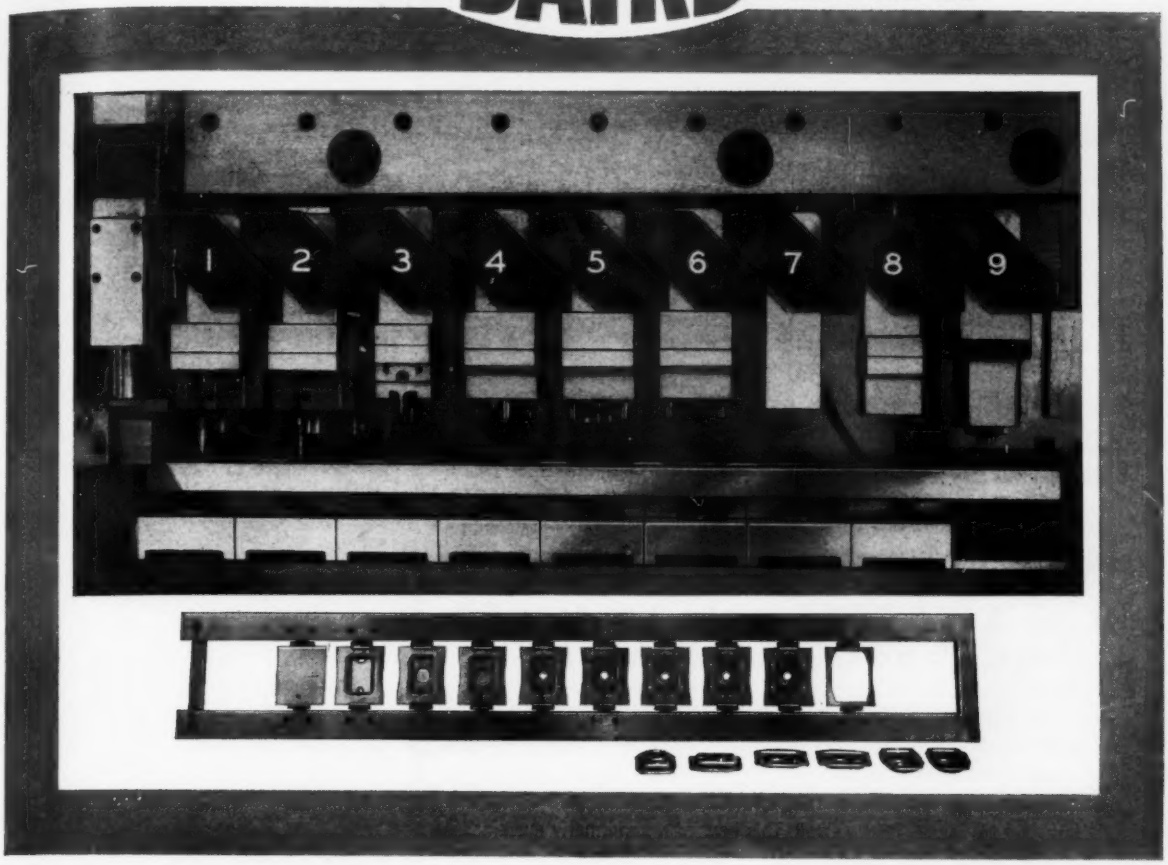
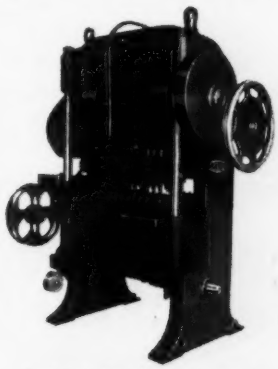
...ask BAIRD about it



How to make money on a "FOUR-FOOT PRODUCTION LINE"

This typical tooling on a Baird Automatic Multiple Transfer Press is, in effect, a complete production line for oven switch plates and a very profitable one at that. Because not only does this machine produce at the rate of 3,600 pieces per hour day in and day out but, like all Baird Multiple Transfer Presses, tool maintenance is extremely low; tool changes when required are very quickly made with minimum down-time.

You, too, can enjoy this kind of HIGH SPEED, HIGH ACCURACY, LOW COST and SMOOTH RUNNING production by combining operations on Baird Automatic Multiple Transfer Presses. Because of Baird's exclusive design, with such important features as gate dwell and new type of transfer mechanism, MORE operations of MORE different types are now possible in a single tooling. It always pays to "ask Baird about it" before you tool. Write Dept TP.



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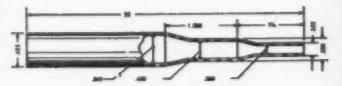
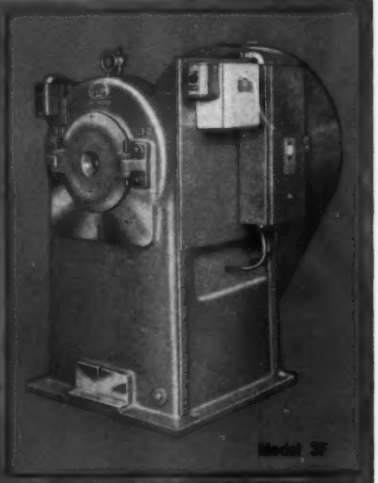
SWAGING TRANSDUCER HOUSING

First pass
Dimensions held to .001 tolerance.

Second pass



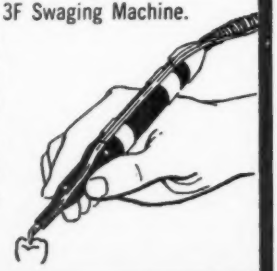
Finishing Housing



How SWAGING cuts costs 80% on Transducer Housing

The Cavitron Ultrasonic Dental Unit provides a marvelous new method for preparing cavities without noise, vibration and heat which contribute so greatly to dental pain and discomfort. Internal dimensions of the transducer housing are critical. A mating cap requires the outside diameter to be rigidly held as well. This housing was formerly machined in two parts and silver brazed together. Now, it is made in one piece from tube stock in 2 passes on a Fenn Model 3F Swaging Machine.

RESULT — Cavitron has not only reduced cost of the Transducer Housing 75% to 80% but now has a simplified one-piece housing that is stronger, easier to make and with a smooth, bright surface resulting from swaging which requires no additional finishing. Write for catalog and full information.



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Talk of the Month

★ ★ ★ ★ ★ ★ ★ ★

THE DYNAMICS OF CONFIDENCE

by L. L. Colbert

President, Chrysler Corporation
Detroit, Michigan

IT IS ALWAYS a pleasure to come back home to Texas — and I don't have to tell you Texans why. But today I am particularly happy to have the opportunity to talk in this state and this city to you members of the petroleum industry about a subject close to my heart — the role of confidence in the dynamic growth of our country. This section of the United States and this industry demonstrate magnificently the fundamentally important truth that it is confidence in our institutions and confidence in the future — not just money or machines or resources — that is the principal force driving this American economy and society ahead year after year and decade after decade.

I want to talk today about some of the down-to-earth reasons behind that confidence — and I want to make a practical suggestion or two as to ways of maintaining it as a vital force. I can't think of any better way to begin than to give you a little shop-talk about what is happening in and around Detroit to make us in the automobile business confident about the year ahead.

You may have noticed in the last week or so that the automobile industry generally has been expressing considerable optimism about the market for cars in 1957. There are some good solid reasons for that optimism. Certainly one of the most important of those reasons is that the industry has made some very sweeping changes in its 1957 models.

All five lines of our Chrysler Corporation cars have been completely redesigned — from bumper to bumper and from tires to roof. When you see them on the street in a few weeks I think you will agree that you never saw cars that looked so wide, so long, so low and so graceful. One of our new cars, for example, is a full

. . . *Continued on Page 10*

*This talk was given by Mr. Colbert in Houston, Texas, before the 37th Annual Meeting of the Texas Mid-Continent Oil and Gas Association.

cost cutting
time saving

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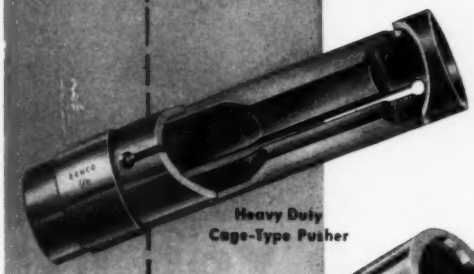
Conventional Pusher


Heavy Duty Cage-Type Pusher

Master Pusher

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Whatever your feeding problem, regardless of the type of machine or material, you get smoother, faster feeding with Benco Pushers and Feed Fingers. Accurate tension is achieved through exclusive design, precise heat treating of oil hardened tool steel and rigid inspection.

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Model "A" Master Pusher shown at left has formed key which holds pads securely in place. New rocker ring allows pads to adjust themselves to a full bearing on bar... avoids scoring of stock. Pushers and pads have longer life and do better work.

Let Benco recommend the right type of Pusher or Feed Finger for your jobs, whether they are simple or difficult; long feed-outs, high speeds or scratchless operations. For best results... for important savings in material, time and money... insist on Benco.

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CIRCLE INFORM-A-GRAM KEY NO. 7

WHICH DIE STEEL WOULD YOU USE

to get "skin-fit" mating—250 million output?

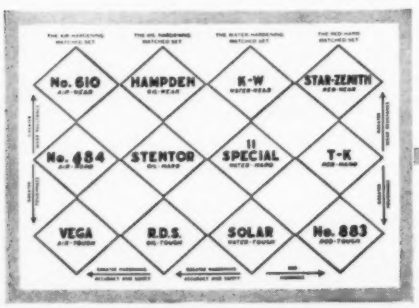
These dies for trimming .003" thick aluminum foil food containers presented the toolroom with this really tough set of tool and die requirements: Make the dies all in one piece . . . finish them to actual size before hardening . . . provide "skin-fit" mating after hardening with no finish grinding . . . and build the dies for multi-million production.

Suppose the decision on which die steel to use were up to you. Would you risk your reputation on any other steel than the one this toolroom decided to use?

Carpenter VEGA (Air-Tough) Die Steel came through with this remarkable performance: After hardening, the toolmaker discovered that the two die sections and two draw rings held to .0003"/.0004" *overall* . . . not just per inch. No finish grinding was necessary . . . a perfect "skin-fit" was assured. Machining the dies from a solid bar of die steel eliminated the need for welded or bolted sections.

The two VEGA rings are engineered to produce a staggering 26 million pieces before any grinding modifications . . . and a total production of 250,000,000 pieces. This Report is one of *hundreds* based upon actual plant records to prove conclusively the improved results obtained with Carpenter Matched Tool and Die Steels.

When will you join the growing number of plants who are enjoying better, lower-cost results? It will pay you to call Carpenter—get in touch with your nearest Carpenter Mill-Branch Warehouse, Office or Distributor today.



Carpenter STEEL

Matched Tool and Die Steels

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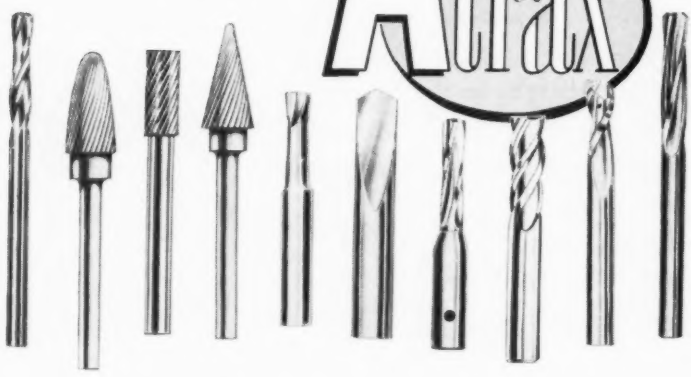

Precision Ground
SOLID CARBIDE TOOLS

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Atrax
THE ATRAX COMPANY
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CIRCLE INFORM-A-GRAM KEY NO. 10

. . . Month's Talk from Page 6

five inches lower than the corresponding 1956 model. Along with the new low silhouette we have greatly increased the glass area all around for wide-open vision. And we have given a fresh accent to the fins and the rear deck.

We have made many changes in the chassis of the new cars, including more powerful engines, improved brakes, and our new three-speed pushbutton transmission. But away up top among these advances is our completely new suspension system. It employs a new frame design, torsion bars, ball joints, outrigger rear springs and rubber mountings that all add up to a stable and level and easy ride of a kind never before obtainable in a production car.

I have given you this one-minute commercial on our new cars because I assume that you, like most Americans, are interested in new automobiles, especially at this time of year. I am not going to make a prediction at this time about the effect of the new cars on the size of the total new-car market in 1957. Let me say only that we at Chrysler are looking forward to a very good year.

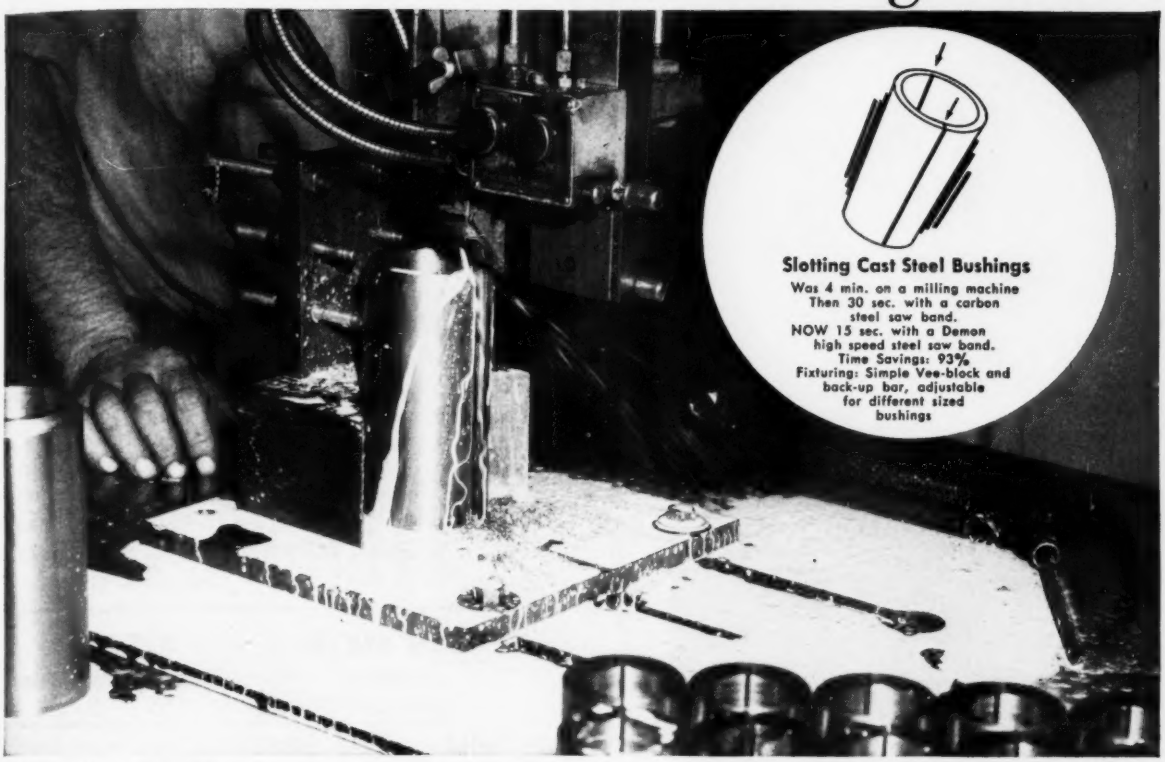
For the long-range future the prospects for the automobile industry, as for the petroleum industry, are very bright indeed. From your point of view as well as from ours the primary factor to take into account in forecasting the future is the remarkable growth of the American population — which is now increasing at a rate of nearly three million a year. What this means is that every twelve months more people are being added to the population of the United States than are now living in Houston and Cleveland combined — suburbs and all. Or put it another way. Our annual population growth amounts to more people than are living in Utah, Nevada, Idaho, Montana and Wyoming combined.

Just recently one of the country's leading population experts stated that if the present trend in the direction of bigger families and younger marriages continues, the population by 1975 is likely to be as high as 249 million. This would mean a net gain of more than 80 million people in the next nineteen years!

The growth of our population is one of the basic reasons for the confidence in the future which is regularly expressed by men in the automobile industry, the petroleum industry, the construction industry and every other line of business that is geared directly to meeting the needs of people. But we are not basing our plans on a straight-line increase of demand in direct proportion to the growth of the population. In a country like ours, where living standards increase even faster than the popu-

. . . Continued on Page 17

How Production Band Machining Cuts Slotting Costs

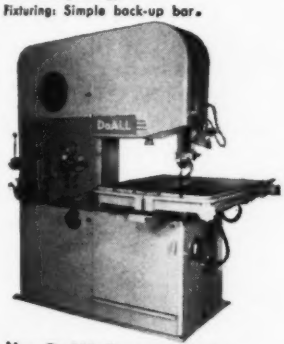


Slotting Cast Steel Bushings

Was 4 min. on a milling machine
Then 30 sec. with a carbon steel saw band.
NOW 15 sec. with a Demon high speed steel saw band.
Time Savings: 93%
Fixturing: Simple Vee-block and back-up bar, adjustable for different sized bushings

Slotting Clamp Brackets

Was 2.5 min. on a milling machine
Then 30 sec. with a carbon steel saw band
NOW 20 sec. with a Demon high speed steel saw band.
Time Savings: 86%
Fixturing: Simple back-up bar.



New DoALL Contour-matic

Hydraulic feed table, integral coolant system, tilting table, infinitely variable speed and feed, high horse power, greater rigidity . . . has more, does more than any other band machine made.

Up to 93% Time Savings

Production slotting, both short and long runs, with a DoALL Contour-matic and Demon saw bands, has proved in every instance, many times faster than other methods.

Typical time savings range from 30% to 90%, with the following bonus benefits:

Lower Initial Cost. Contour-matic band machines with power feed tables and accessories that adapt them to a broad range of work often cost as little as ½ as much as slower single-purpose machines.

Lower Fixturing Cost. Downward thrust of saw band forces work against table, eliminating high-priced work hold fixtures. In most cases, a simple back-up bar is all that is needed.

Greater Machining Versatility. The DoALL makes straight or contour cuts . . . and it will grind, polish, slice or file on a production basis, too.

Fixture Service. A complete fixture service for production work is available —including design, time study and fixture manufacture.

Free Literature. Catalogs of DoALL Contour-matic band machines are available — write for them.

Free Movies. Sound color— "Production Band Machining," 30 min., "Production Tooling," 10 min.

DoALL

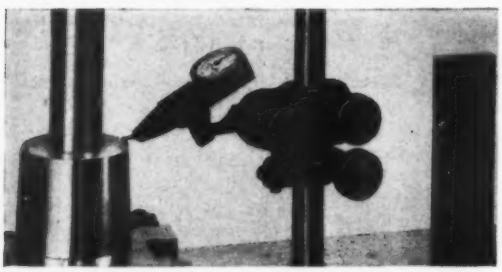
Free In-Your-Plant Demonstration. Call your local DoALL Sales-Service Store or write:

THE DoALL COMPANY, Des Plaines, Illinois

PB-29

CIRCLE INFORM-A-GRAM KEY NO. 11

CHECK MASTER contact point on work piece shown 20 times actual size. To see the smallest variations CHECK MASTER will detect, illustration would need to be 500 times actual size.



CHECK MASTER in use checking face location on surface plate.

The importance of measuring practically nothing

In gaging, the smaller the variation, the harder it is to measure. Yet, accurate checking of microscopic variations is what makes the difference between ordinary and truly fine precision manufacture.

CHECK MASTER

Is so unusually sensitive that it responds to dimensional variations as fine as .000020"!

Use this versatile precision instrument in setting up work ON a surface and truing pieces IN machine tools. You'll find it superior in actual feature-by-feature comparison to any similar device in the industry. (See chart below)

COMPARATIVE ANALYSIS OF TEST INDICATORS

	STANDARD CHECK MASTER	Make A	Make B	Make C	Make D	Make E
Bearings Jeweled	ALL	Some	None	None	None	Some
Bearings Removable	ALL	Some	Some	None	ALL	ALL
Pivot Ends Covered	YES	YES	No	No	No	YES
Ratchet Contact Point	YES	YES	YES	No	YES	No
Contact Pressure (gr.)	15-15	23-33	23-33	23-23	45-49	28-38
Contact Pressure Equal in Both Directions	YES	No	No	YES	No	No
On-Center Mounting Vertical & Horizontal	YES	No	Vert. Only	No	Vert. Only	No
Absence of Reversing Lever	YES	No	No	YES	No	No
Total Weight (grams)	29	42	33	70	77	35
Hand Rotation Always Clockwise	YES	No	No	YES	No	No
.001" & .0001" Convertible	YES	No	No	No	No	No

Write today for complete information
Ask for CHECK MASTER Bulletin.

STANDARD®

Gage Company, Inc.

146 Parker Ave., Poughkeepsie, N. Y.

STANDARDIZE ON STANDARD FOR PRECISION GAGES

CIRCLE INFORM-A-GRAM KEY NO. 12

For your protection when you want GRAPH-MO® tool steel remember...

THERE IS ONLY ONE GRAPH-MO TOOL STEEL and it is made *only* by the Timken Company. Graph-Mo is a registered trade-mark owned by The Timken Roller Bearing Company covering our own graphitic type oil-hardening alloy tool steel.

GRAPH-MO IS THE ORIGINAL OIL-HARDENING GRAPHITIC TOOL STEEL. Graph-Mo is a metallurgical development of The Timken Roller Bearing Company, who developed and promoted the graphitic type tool steels.

GRAPH-MO TOOL STEEL IS AVAILABLE ONLY through the authorized tool steel distributors of The Timken Roller Bearing Company.

MAKERS of quality dies, gages, punches and machine parts rely upon the Graph-Mo® trade-mark to insure the quality and economy needed for their parts. We're proud of that confidence. We prize Graph-Mo's reputation. The trade-mark Graph-Mo helps us protect this reputation. That trade-mark protects *you,* too. Here's why:

The trade-mark Graph-Mo identifies the most stable, machinable and wearable of all tool steels. By specifying Graph-Mo, the original graphitic tool steel, you can always be sure of these advantages and the high quality you've come to expect from Timken fine alloy steels.

To be sure you get Graph-Mo, always specify it by name. And remember it is available only through authorized distributors of the Timken Company. For more information about it or our other specially developed graphitic tool steels, send for the new 10th edition of "Timken Graphitic Steel Data Book". Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO". Tapered Roller Bearings, Alloy Steel and Seamless Tubing, Removable Rock Bits.

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

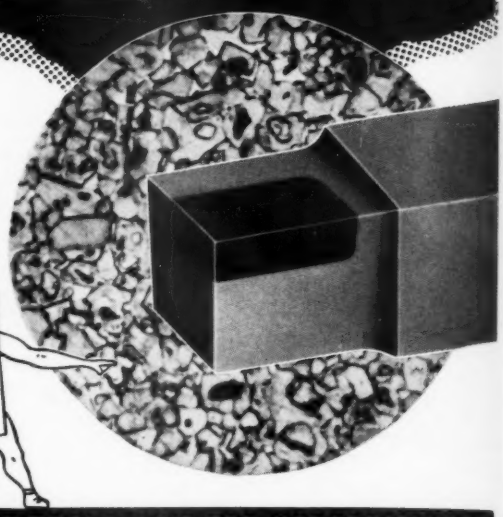
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

CIRCLE INFORM-A-GRAM KEY NO. 13

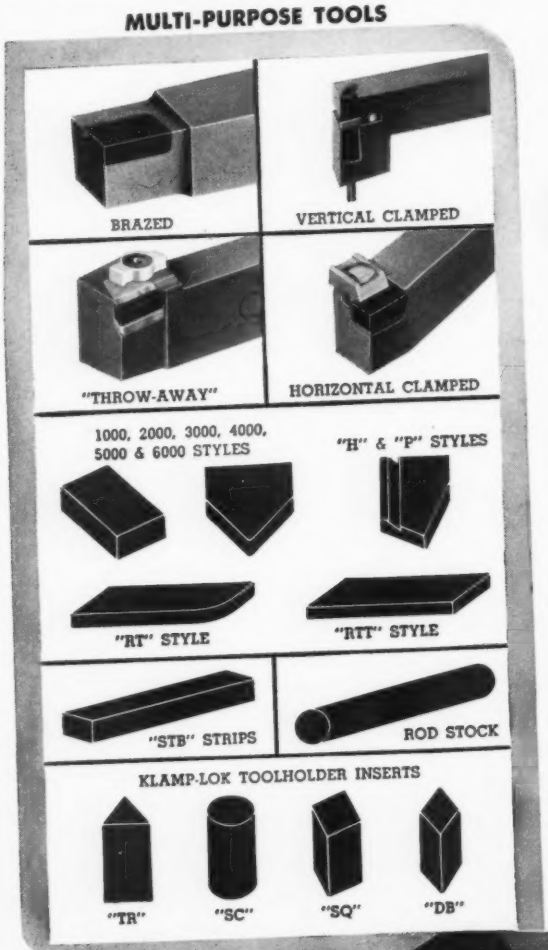
All Tools May Look Alike—But it's What's INSIDE That Counts

● An extensive, 2-year research program has produced a new series of Talide Metal grades having greatly improved hardness, strength, rupture-resistant and crater-resistant qualities. Users can now get maximum benefits from today's high-speed "automation" machines. Record production runs and continuous machine performance is assured with super-hard, super-tough Talide Tools.

● Universal acceptance of Talide Metal has made possible construction of a new 100,000 sq. ft. multi-million dollar plant at Youngstown, Ohio. Doubled production facilities assure prompt delivery and fast service. All Talide Metal grades are uniform and consistent in quality. They are processed in latest type vacuum electric furnaces under rigid laboratory control. Every test **proves** Talide is Best!



MULTI-PURPOSE TOOLS



TALIDE TOOLS GIVE TOP PERFORMANCE

40% more forgings cut at Automotive Engine Plant.

Part.....C-1141 steel forging 1-1/2" dia. x 14" long.
Operation.....Turning multiple diameters.
Machine.....New Britain Chucking Lathe.
Tool.....Talide triangular insert #TB-12123, Grade S-88 (Industry Code C-5), mounted in Klamp-Lok Toolholder.
Depth of Cut.....1/8" to 3/32" R.P.M.....1540
S.F.P.M.....580 Lubrication.....None
Results.....71 forgings machined per edge per grind compared to 49 machined with best competitive premium grades.

Double Production obtained at Electric Motor Plant.

Part.....1040 steel pump shaft, Brinell 186.
Operation.....Turning 3 diameters and 1 taper.
Machine.....Sundstrand Automatic Lathe.
Tool.....Talide triangular "Throw-Away" insert, 3/8" I.C. x 1/8" thick, Grade S-92, mounted in Klamp-Lok Toolholder.
Depth of Cut.....3/8" Feed.....021" S.F.P.M.....300
Results.....31 shafts machined per edge per grind. Best competitive premium grade produced only 16 before fracturing. Exceptional toughness of Talide grade evidenced by only slight mushrooming of edge—no fracturing.

Call in a Talide sales engineer to recommend proper tooling for your machining operations, or write for 84-page catalog No. 56-G. *METAL CARBIDES CORPORATION, 6001 Southern Blvd., Youngstown 12, Ohio.*

SEND FOR SPEED & FEED CHART— Pocket-size plastic chart gives complete information on speeds, feeds, relief angles and recommended grades for cutting all metals.

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 7, OHIO

HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 14

NEW!

ROTOR AIR SCREW DRIVERS AND NUT SETTERS

Powerful! Light!

- Rugged . . . long-life construction
- More power per pound
- Simplified torque adjustment
- 3 types of drives
- Reversible or non-reversible motors

TYPICAL SPECIFICATIONS
Reversible* . . . Adjustable Clutch† Type

Type	Handle ¼" Air Inlet	Free Speed at 90# Pres.	CAPACITY Free Run. Screws	Bolt Size	Wt. (Lbs.)	Lgth. (Ins.)	Spindle Side to Center (In.)
S-02-PRC	Pistol	2000	#2 to #12	To ¼"	2¼	8¾	25/32
S-02-PRC	Pistol	850	#2 to #12	To ¼"	2½	9¼	25/32
S-02-PRC	Pistol	450	#2 to #12	To ¼"	2½	9¼	25/32
S-02-LRC	Lever	2000	#2 to #12	To ¼"	1⅞	10	25/32
S-02-LRC	Lever	850	#2 to #12	To ¼"	2⅛	10½	25/32
S-02-LRC	Lever	450	#2 to #12	To ¼"	2⅛	10½	25/32

*Also Non-Reversible †Also Positive Clutch and Direct Drive

Here's how to drive assembly costs down

WRITE FOR BULLETIN No. 46

THE ROTOR TOOL CO.
CLEVELAND, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 15

Speed Precision Boring

and maintain accuracy of .0002" in 12" with the

Kearney & Trecker Model B Autometric Precision Boring Machine

Here it is . . . unmatched for precision boring of small work . . . either single pieces or production lots! Work progresses rapidly on the versatile Model B because multiple boring operations can be completed *in just one setup.* These additional features save time, eliminate errors, and make the rugged Model B easy to operate . . .

Convenient operating controls • Ease of control • Ease of setup • Built-in index table and measuring instruments • Wide range of feeds and speeds • Complete line of especially selected accessories.

Model B Autometric: 16" dia. table; 10" Vert. Travel; 16" Transverse Travel; 15" Carriage Travel; 8 speed changes—.0005" to .0148" per Spindle rev.; 50 to 2500 rpm. For complete details, ask for Catalog No. BMA-10.

KEARNEY & TRECKER MILWAUKEE

Designers and Builders of Precision and Production Machine Tools Since 1898

CIRCLE INFORM-A-GRAM KEY NO. 16

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CIRCLE INFORM-A-GRAM KEY NO. 16

. . . Month's Talk from Page 10

lation, that kind of planning wouldn't be realistic. *The dynamics of confidence which we are witnessing today are based in large part upon the certainty that the tidal waves of young Americans that will start rolling in on us in the early 1960's are going to demand far more of life than their fathers and mothers did.* They are going to multiply the pressures of demand on all lines of business, away out of proportion to their tremendous numbers.

In the automobile business we expect our customers to become more and more interested in the newer developments of the kind appearing in our 1957 cars. And in the years ahead, as new and improved automobiles are bought and used, first as new cars and then as used cars, we expect the older models to be scrapped at increasingly high rates. We believe the scrappage rate will increase in the next ten years to something like five million cars a year. With the industry building five million cars just as replacements, with a great proportion of the million or more new families each year buying cars, and with multiple-car families continuing to increase, we can begin to see the outlines of an average yearly market of something like 8 million cars by 1965. During the later nineteen-sixties some years may be considerably bigger than that, probably even reaching 10 million cars.

By 1965 the total car population may very well be in the neighborhood of 70 million. This estimate is based on a probable population of 193 to 195 million, a sharp rise in the proportion of suburban family units, a marked increase in the number of multiple-car families, a sustained rise in the real incomes of the bulk of American families, and the probability that living habits will become increasingly dependent upon automotive transportation as the result of better highways and more leisure. I leave it to you men to estimate what this expanded automobile population and its increased use will mean in terms of markets for petroleum products.

The most optimistic estimates of the future car population may turn out to fall far short of actuality if the automobile industry comes up with a revolutionary new kind of engine — lighter, quieter, more responsive and more efficient than anything we now have. A development of this kind would make every car on the road obsolete, and every company in the business would be working under forced draft to meet the demand. If that engine should turn out to be a gas-turbine similar to the one that powered a Plymouth on a transcontinental run last spring, the

. . . *Continued on Page 18*

Toolmakers' Microscope
Ultimate in measuring microscopes. Range 2" x 4", reading to 0.0001", angular measurement to 1 minute.

Precise measurement to 0.0001"

Slash rejects, save money with Gaertner measuring microscopes

Precise, versatile, easy-to-use Gaertner measuring microscopes assure positive, direct measurement of precision parts. You see clear, sharply-defined images. No physical contact to distort or injure object being measured. Enjoy new production savings with Gaertner optical instrumentation. Write for complete data on the Gaertner line of industrial microscopes.

Coordinate Measuring Microscope
High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

Micrometer Slide Comparator
Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

Scale Micrometer or Shop Microscope
High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002".

Write for Bulletin 161-54 showing applications, models, specifications.

The Gaertner Scientific Corporation
1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

CIRCLE INFORM-A-GRAM KEY NO. 17

WHEELOCK, LOVEJOY & COMPANY, INC.
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7 WAREHOUSES AT YOUR SERVICE

You'll get quick action on your order for alloy steel bars, billets or forgings . . . no matter what size, shape or heat treatment you require . . . when you call any one of our seven warehouses.

All seven are conveniently located in principal industrial areas. Each is staffed by expert metallurgists, and is well-stocked to give you speedy service.

Fill your current needs by ordering our own HY-TEN steels, the "standard steels of tomorrow", or standard AISI or SAE grades.

Or write today to our Cambridge office for your *free* Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

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HOME OFFICE:
WHEELOCK, LOVEJOY & COMPANY, INC.
135 Sidney Street, Cambridge 39 Massachusetts

CIRCLE INFORM-A-GRAM KEY NO. 18

. . . Month's Talk from Page 17

petroleum industry would also have some adjustments to make since the gas-turbine requires no octane rating in its fuel and can use a very wide range of hydrocarbons. As it looks to us, in producing an optimum fuel for the gas-turbine, you in the petroleum industry might find yourselves taking a much broader cut out of a barrel of crude oil than you do in producing any present-day automotive fuel. This would seem to us to be very much to the long-range advantage of the nation in making the most of our petroleum reserves.

Let me assure you that there is no prospect that you will have to change your refining or distributing practices in the immediate future to adjust for the gas-turbine engine. The piston engine still has a long and useful life ahead of it. It is also true, however, that *the gas-turbine seems to have greater developmental possibilities than any other automotive engine we know about.*

Compared with you people in the petroleum industry, we in the automobile industry may seem to be changing our products and processes at a comparatively modest speed. Your achievements in the fields of exploration, refining, distribution, and new product development, including synthetics, are among the great wonders of the modern industrial world. But in the metal-working industries the speed of change has also been very impressive. Let me tell you about just a few of the major advances made in recent years in our automobile manufacturing techniques.

Some of our greatest gains have been made in pressing and stamping metal for automotive bodies. Seven years ago most big presses were capable of turning out large stampings at the rate of approximately six strokes a minute. Today there are presses with new automatic materials-handling devices which can operate all day long at eighteen strokes a minute or better. This is a gain of at least three to one since 1949.

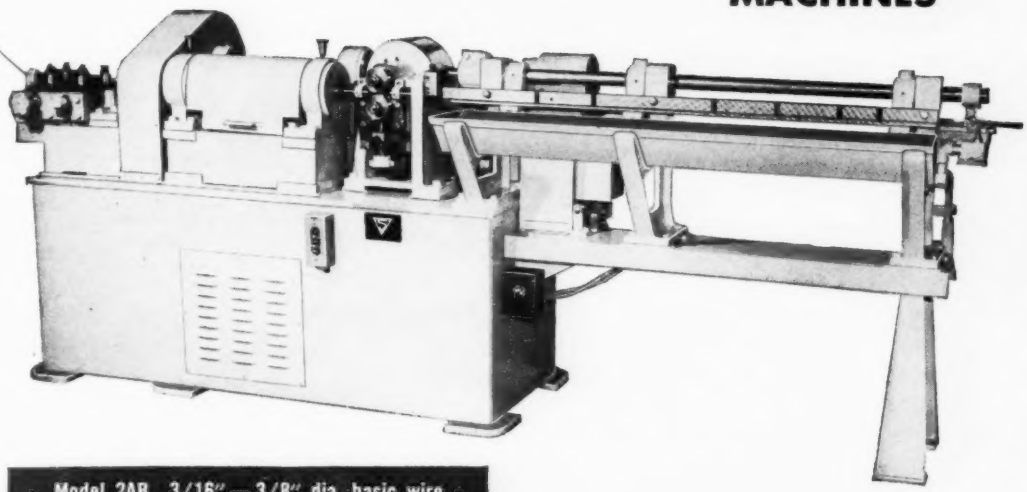
Virtually all of the machine tools we use for cutting metal have made very rapid advances over the past ten years. Some present-day lathes, for instance, are turning fifteen times as fast as those in use before World War II. And the development of new cutting metals such as tungsten carbide has greatly increased the depth of their cut. The newer metal-cutting tools not only work much faster than former models but also cut to much closer tolerances than we once thought possible.

A whole new industrial frontier is now being opened up by the development of what we call "chipless" production. Just at the time when

. . . Continued on Page 23

SHUSTER

WIRE STRAIGHTENING AND CUTTING MACHINES



Model 2AB 3/16" — 3/8" dia. basic wire

Now — All Electric!

Electrical control of Target and Clutch now standard equipment on all models!

Electronic cut-off on both constant and variable speed Shuster machines produces accurate, square, clean-cut lengths of wire! Operator simply locks the stop rod gauge for desired length of cut. Target operated by sensitive microswitch. Electric brakes standard equipment on large models.

- Cut square, true, undistorted ends
- A model for any job from .025 to 11/16" diameter
- Simple, economical operation
- Trouble-free maintenance
- Variable or constant speed machines
- Over 30 models to fit your needs
- Flat and square stock machines available

Also available: Tube straighteners, feed starters, reels, roll straighteners, short-cut machines.

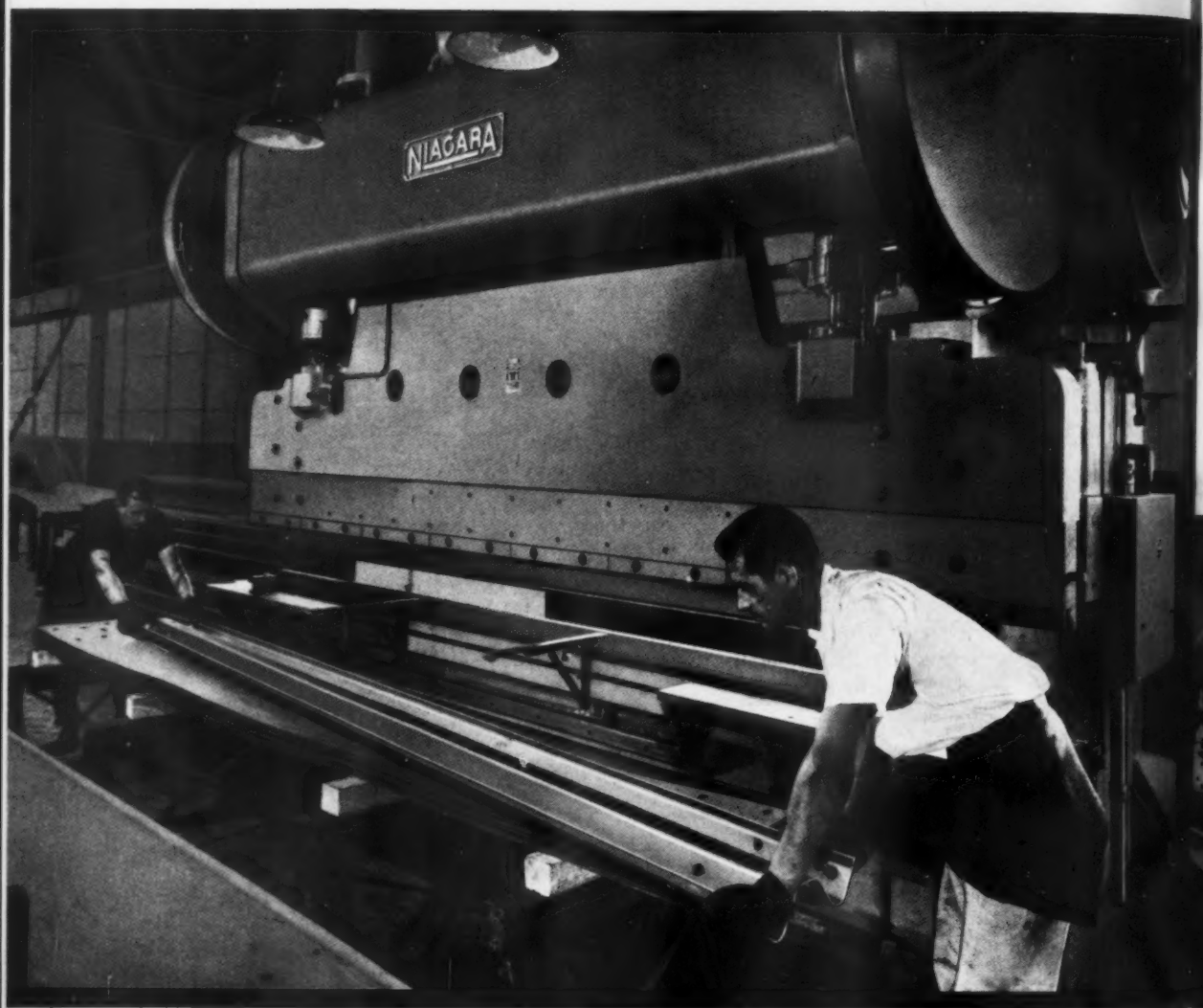
Write for literature!

Constant speed SHUSTERS
from .025 to 1/2" dia basic wire

Variable speed SHUSTERS
from 1/16" to 11/16" dia basic wire

CIRCLE INFORM-A-GRAM KEY NO. 19

"we go back to



(Above) Forming highway guard rails from 12 gage steel on Niagara 520 Ton Press Brake.

(Right) Piercing rails with same machine.

(Far Right) Forming chair seat frames for office furniture from 20 gage steel on Niagara 150 Ton Press Brake.

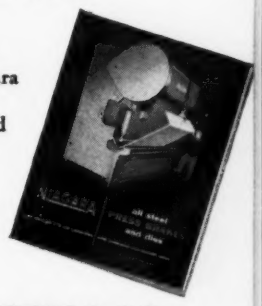
Niagara for Press Brakes"

"The personnel of our organization has been acquainted with Niagara equipment for years. Niagara will stand behind *any* equipment furnished. Many millions of operations in the past 5 years on their presses and press brakes... equipment satisfactory from both the operational and safety standpoint. Our intention is to use the Niagara line entirely."

There in the words of one customer (a large Ohio metal fabricator whose press brake operations are illustrated), you have the sentiments of hundreds. Once experienced with *any* of the other metalworking machines which Niagara makes... presses, shears, bending rolls and dozens more... one just naturally thinks first of Niagara whenever the subject of press brakes comes up.

REASONS ARE MANIFOLD: (1) Extreme helpfulness of Niagara's engineers in selecting the machine and accessories that will do the job best (no other manufacturer can offer so complete and large a line of sheet and plate metalworking equipment). (2) Unrivaled reputation and experience in the field, dating back 77 years, that assure unquestioned reliability. (3) World-wide recognition for design leadership, combining rock-bottom operating economy and top-notch performance in *every* product it makes (take a moment to run down this partial list of imposing press brake features):

- *Double end twin drive with double reduction gearing for smooth, uniform application of power at both ends of ram.*
- *Rugged, all-steel frames with box type crowns of unequaled strength and rigidity.*
- *Extra heavy, rigid bed and ram for maximum support of dies.*
- *Gearing totally enclosed in sealed oil baths for thorough, clean lubrication.*
- *Longer lasting, laminated, nonmetallic ways.*
- *Powerful, smooth-acting, multiple disc clutch and brake.*
- *Gibs maintain accurate, endwise alignment of ram.*



Standardized in a complete line, ranging from 50 through 775-ton capacities, Niagara Press Brakes are built to produce a tremendous variety of work uniformly and accurately. Post yourself now on all the details by requesting Bulletin 89 D and, as soon as you can, avail yourself of some really worthwhile suggestions from a Niagara representative. Write.

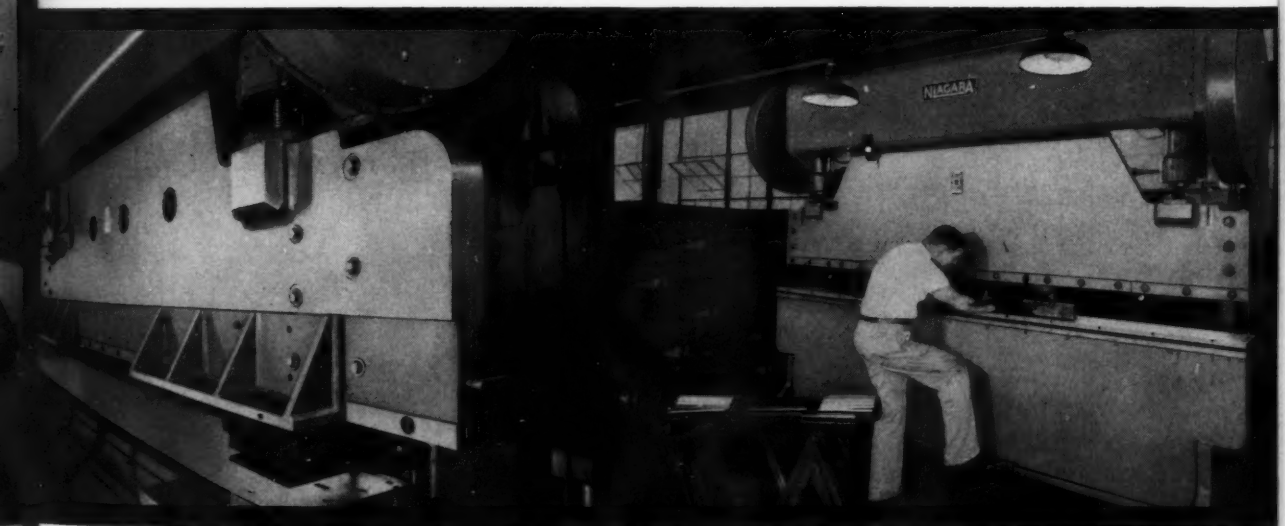
NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

DISTRICT OFFICES:

Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U.S. cities and major foreign countries

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

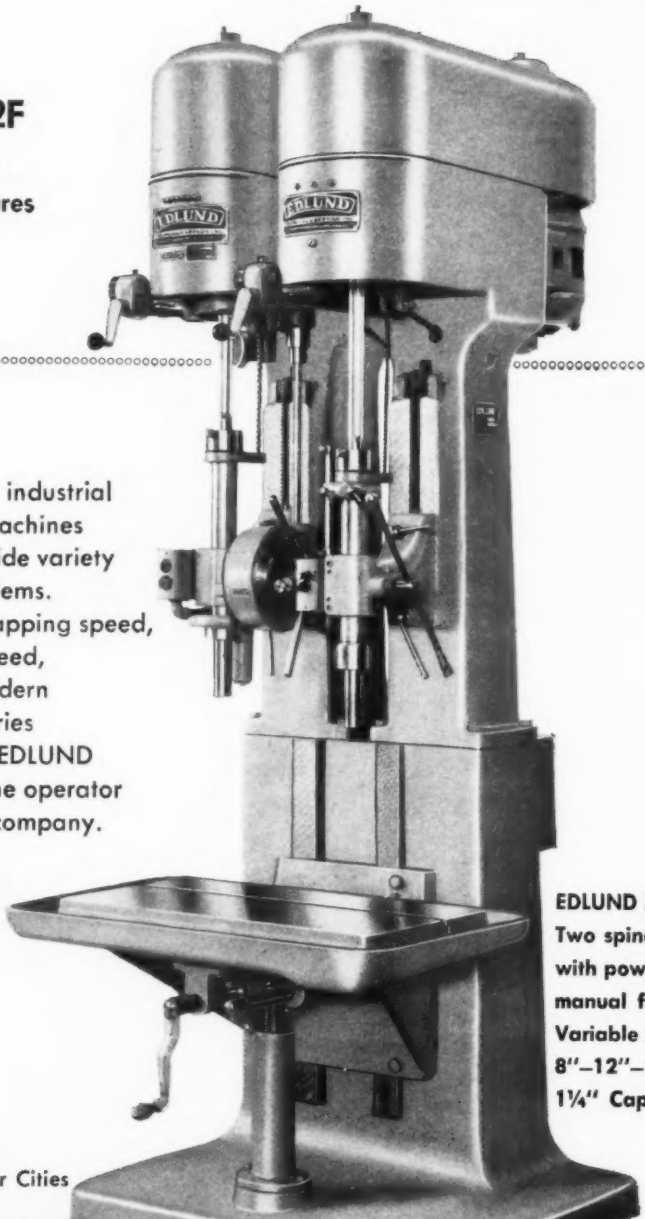


NIAGARA PRESS BRAKES

EDLUND AMERICA'S MOST VERSATILE DRILLING MACHINE

EDLUND Model 2F

Infinitely Variable Speed
Modern Production Features
Long Lasting—
Rugged Construction



The changing pattern of industrial production requires machines readily adaptable to a wide variety of production problems. Selection of **any** drilling or tapping speed, manual or power feed, and many other modern production accessories make operation of the EDLUND Model 2F a pleasure for the operator and good sense for the company.

Write for Bulletin 140R.

EDLUND Model 2F
Two spindle combination with power feed and manual feed.
Variable speeds to 3600 rpm
8"–12"–15" Overhang
1¼" Capacity

EDLUND Representatives in Major Cities

EDLUND MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

Write for Bulletin G56 —Complete Line with Cam Feed Units
Bulletin 160 —Model 1F–High Speed
Bulletin 170R—Model 4F–Production

CIRCLE INFORM-A-GRAM KEY NO. 22

. . . Month's Talk from Page 18

metal-cutting machinery is being advanced to an entirely new stage in its development, we are learning very rapidly how to cast, forge, squeeze, push and pull metal into the shapes we want with a very high degree of precision. In a few years we may look back on our present method of machining rough castings and forgings as a quaint and old-fashioned way of doing things. As an illustration of this trend, we now have new equipment on order which will cold form certain engine parts to exact, final dimensions from bar steel instead of machining rough forgings and castings.

This kind of progress is going on at an accelerating pace in every part of the automobile industry, and in every other kind of manufacturing.

I haven't said a word about automation. This is intentional. In my opinion, *it is high time that people began to think of automation as only one phase of the tremendous, broad advance being made in machine technology and time to take due notice of the progress being made in all its other phases.*

All across the wide front of science and technology similar developments are taking place at the same break-neck speed. These developments mean we are finding more efficient ways of producing for our established markets so as to build greater values into our products and thus increase demand. They mean that we are creating new products and new markets. They mean we are adding to the nation's strength and to the health, wealth and welfare of the American people. And in this uncertain world these developments also give us strong assurance about the future.

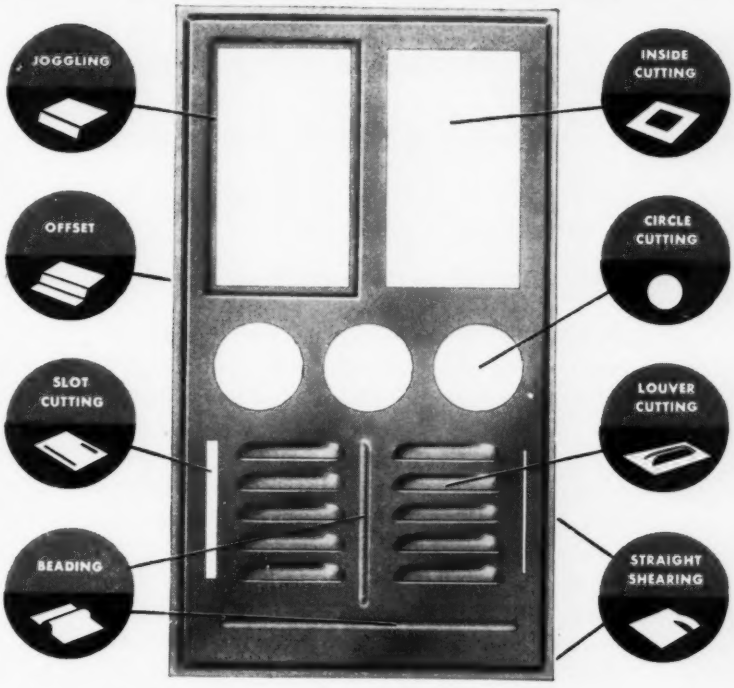
To those of us who live in the demanding world of business competition, dedication to the future is a down-to-earth, practical necessity. To remain competitive in today's world a company must relate itself to the long-range future in every phase of its activities. A modern industrial organization plans its future years in advance and backs those plans by putting money on the line for research and development and for new plants and equipment.

Long-range capital investment programs are now considered standard operating procedure. But only a few years ago they were the exception rather than the rule. Nine years ago, when McGraw-Hill started making its surveys of projected capital investment, only a handful of companies could furnish estimates of expenditure in plant and equipment beyond the current year. Now, over ninety per cent of the companies cooperating in those surveys can give estimates of their capital expenditures three years ahead or longer.

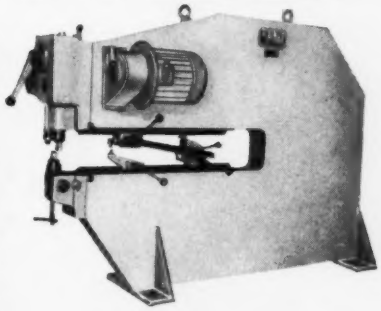
. . . *Continued on Page 28*

PULLMAX METALWORKING IDEAS

Expensive dies eliminated with standard Pullmax Tools



This instrument panel board made complete on a PULLMAX



Only the Pullmax universal shearing and forming machine has the versatility to do all of the metalworking jobs in your Model Shop, Engineering or Maintenance Departments.

This one versatile machine does straight shearing, inside or outside circle cutting, design cutting, inside square cutting, beading, joggling, slot cutting, louver cutting, dishing, edge bending and flanging.

7 sizes of machines cut up to 11/32" in mild steel. Ask for a demonstration right in your plant.

AMERICAN PULLMAX CO., INC.
2469 N. Sheffield Ave., Chicago 14, Ill.

MORE MONEY-SAVING METALWORKING IDEAS ARE YOURS IN THIS *FREE* BOOKLET

Please send us the Pullmax Catalog on Money-Saving Metalworking ideas.

NAME_____

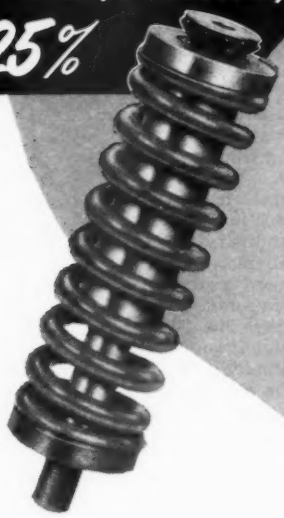
STREET_____

CITY_____ ZONE_____ STATE_____

TITLE_____

CIRCLE INFORM-A-GRAM KEY NO. 23

WALES "Strippits" can save up to 60% time, BOOST PROFITS 25%



. . . stripping metal from conventional dies the 'WALES-WAY'

WALES STRIPPITS are springs, held compressed by retainers. Uneven stripping pressure is eliminated completely, being constantly standard at all points and at all times.

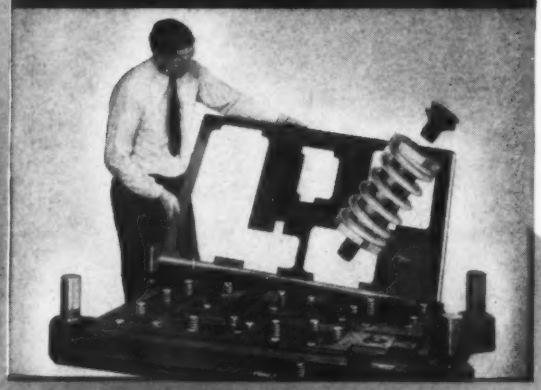
Get rid of the costly delays caused by removing dies from the press to repair broken punches, springs or defective die steel. With WALES STRIPPITS, dies never need be removed nor dismantled in order to make repairs.

Stripper plates can be removed quickly and easily, in the press, with WALES STRIPPITS. The plates can be one half conventional thickness or non-existent because there is no pressure exerted until the Strippits go into action.

Save up to 60% man hours and material cost in die making the 'WALES-WAY'. All machining of punch holder and die shoe is done from the 'face' side.

Installation of WALES STRIPPITS is so easy. Saves hours in setting up any die pattern. No springs to grind, no stripper bolts to make, no drilling and counter-boring for stripper bolts, no spring pocket boring. WALES STRIPPITS pay for themselves over and over in time saved on every job. Use the same WALES STRIPPITS many times over. Shops throughout the country use and recommend WALES STRIPPITS.

NO STRIPPER PLATES USED HERE



This picture shows work blanked by die, equipped with WALES STRIPPITS. Even STRIPPIT pressure releases work piece instantly.

Why not use our ENGINEERING SERVICE?

Our Engineers will be happy to make an analysis of your production and give you suggestions as to how WALES STRIPPITS can supplement your present methods and INCREASE YOUR PROFITS. No obligation, of course.

Send for BULLETIN NO. 11L

Filled with pictures and examples of WALES STRIPPITS in use. Information that should be valuable in YOUR shop. It will be mailed to you without charge and by return mail.

WALES Strippit CORPORATION

"...the Wales-Way is the PLUS-PROFIT way"

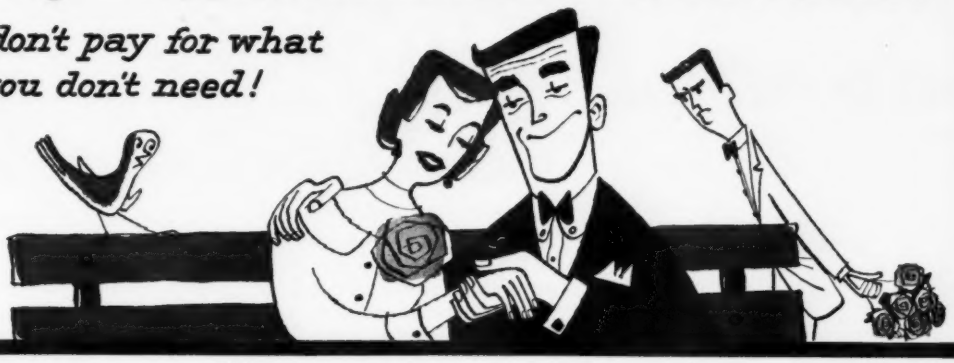
345 PAYNE AVE. — North Tonawanda, N.Y.

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

CIRCLE INFORM-A-GRAM KEY NO. 24

Don't buy a BOUQUET...when a ROSE will do!

...or don't pay for what you don't need!



Model D-24, 28

SIBLEY DRILLING MACHINES...

- **Drill 1¾" in Steel Plate.**
- **24" and 28" Swing. 5 H. P. Motor**
- **Table Swings On Round Column— Save Set-up Time! Get More Versatility!**
- **Accuracy—Simplicity**
- **Ruggedness For Any Job!**

Increase Output at ½ the Investment! Simple arithmetic proves the Model D-24 a money-maker for you. Charge its cost to your work and compare! Meeting close tolerances reduces rejects. Ease of operation and simplified tooling cuts time. Accessibility permits easy repair.

Send for Free Catalog!

SIBLEY
MACHINE & FOUNDRY CORP.
SOUTH BEND, INDIANA

SIBLEY MACHINE & FOUNDRY CORP.
Dept. TP 12 South Bend 23, Indiana
Send Catalog No. 68A

Name_____ Title_____
Company_____
Address_____
City_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 25

INDEX *short or long runs on a production basis*

with Hartford Special SUPER-SPACERS

- **Quick, easy setups without expensive jigs or fixtures.**
- **Positive, rapid indexing accuracy in a minimum of .00116" on a 4" radius, noncumulative.**
- **Super-Spacer can be indexed visually to any degree setting with Vernier accuracy, and locked in position.**

12" SUPER-SPACER

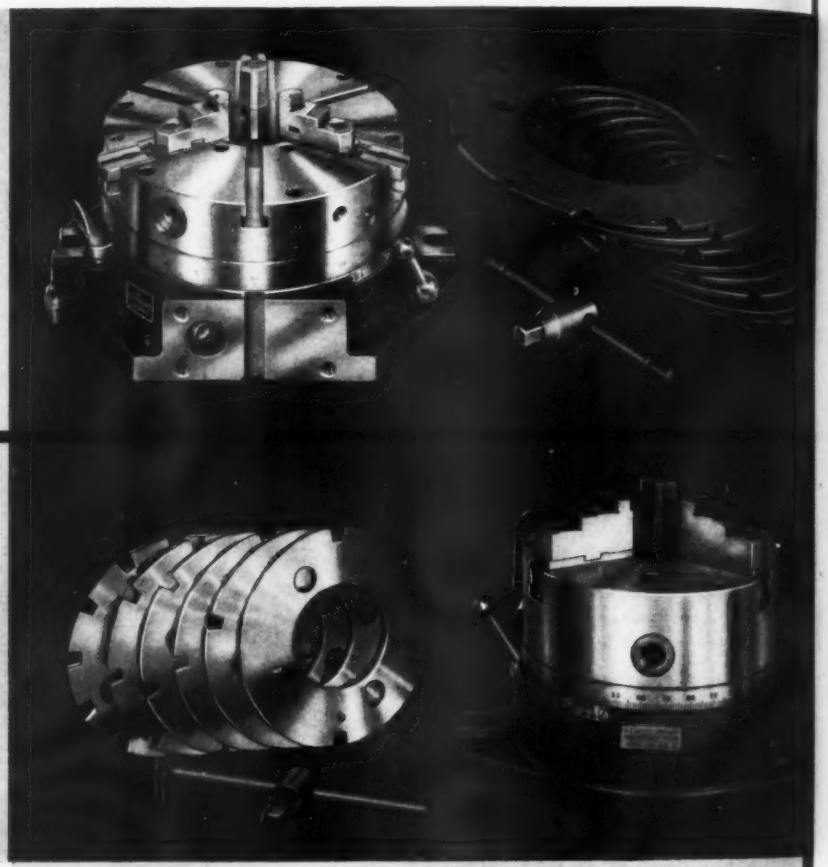
Length overall:	16"
Width overall:	12½"
Base to chuck face:	6 13/32"
Width of keys:	1 1/16"
Thru hole diameter:	4"
Chucking diameter:	½" thru 12½" O.D.
Weight:	190 lbs.

Mask plates for divisions from 2 through 27 are available from stock. 2, 3, 4, 6, 8, 12, 16 and 24 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order. 48 notch master index plate furnished with standard unit. Special master index plates for 27 through 54 divisions carried in stock. Special index plates for unequal spacing made to order.

8" SUPER-SPACER

Length overall:	12⅛"
Width overall:	10⅛"
Base to chuck face:	6 3/4"
Width of Keys:	1 1/16"
Thru hole diameter:	2½"
Chucking capacity:	⅛" thru 8" O.D.
Weight:	110 lbs.

Mask plates for divisions from 2 through 18 are available from stock. 2, 3, 4, 6, 8 and 12 notch plates are furnished with the standard unit. Special mask plates for unequal spacing made to order.
24 notch master index plate furnished with standard unit. Special master index plates for 16 through 36 divisions carried in stock. Special index plates for unequal spacing made to order.



Thousands of users the world over proclaim Hartford Special Super-Spacer The Standard of Indexing Devices for —

Milling	Boring	Inspecting
Drilling	Slotting	and other
Tapping	Planing	Machining Operations

A complete line of accessories available. See the Hartford representative in your area or write for Bulletin S-104.

HARTFORD *Special*

MACHINE TOOL ACCESSORIES DIVISION
THE HARTFORD SPECIAL MACHINERY CO.
29211 HOMESTEAD AVENUE HARTFORD 12, CONN.

Logan

- 12" SWING
- 1" COLLET CAPACITY
- 1⅝" SPINDLE BORE
- 23" and 35" CENTERS
- VARIABLE SPEED OR DOUBLE V-BELT DRIVE

ACCURACY, CAPACITY AND POWER COMBINED IN THIS 12" LATHE

This 12" swing lathe typifies Logan advanced design and rugged construction. Gears are extra wide and strong. Shafts are extra heavy. The lead screw has a full ⅞" diameter. The precision carriage rides on a two-V-way, two-flat-way bed that is rugged, precision ground and warp-free. The heavy spindle turns on oversize ball bearings, no bearing adjustment needed for any speed between 38 and 1575 rpm. This lathe, and every Logan Lathe from 14" swing down to 9" swing, is dynamically balanced before it is shipped. The result is *sustained accuracy* and smooth, quiet power on every lathe turning operation. See your Logan Lathe dealer for more facts—or mail us the coupon below.

No. 2557-V
12" Swing,
Variable Speed Drive
35" Centers

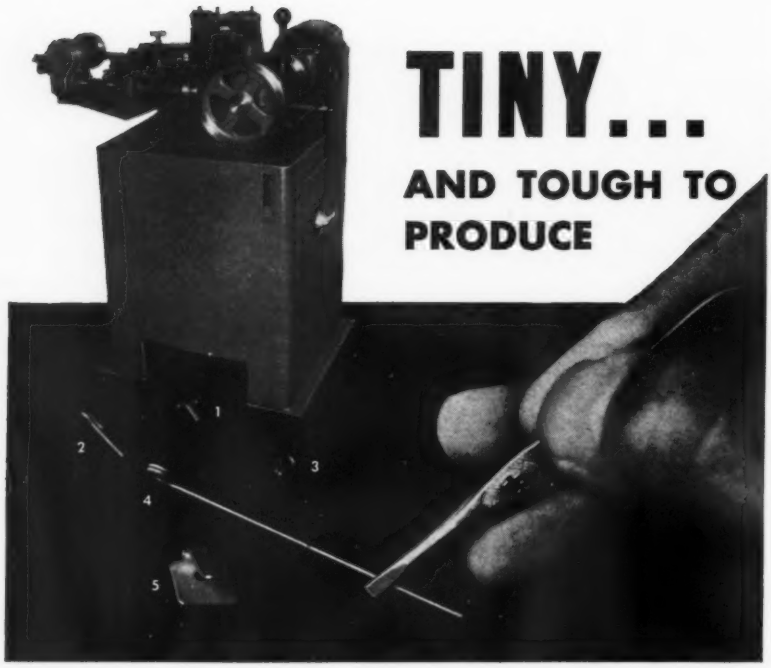
THIS COUPON
will bring you full details on Logan Lathe construction and specifications.

LOGAN ENGINEERING CO.
4901 West Lawrence Avenue, Chicago 30, Ill.

Send me full facts on the Logan line.

Name.....
Company.....
Street.....
City.....Zone....State.....

CIRCLE INFORM-A-GRAM KEY NO. 27



INTRICATE FORMING IS AUTOMATIC ON A NILSON 4-SLIDE

Small wire and ribbon metal forms shown here in actual size are typical examples of modern precision production on a Nilson #00 4-Slide. Compact in size, this 4-Slide produces up to 375 pieces per minute in material not exceeding .040 dia. and 3" in blank length. Easy access to tooling, accurate feeding to within .003, and rugged construction assures years of precision forming.

1 Mercury Switch Part . . . .014" x .019" platinum wire, formed with tolerances within .001" on over-all length. Production rate, 175 per minute.

2 Electrical Contact . . . .0076" x .0030" wide phosphor bronze formed at a production rate of 200 per minute.

3 Swivel Part . . . .025" brass wire. Heading operating includes eye formed with tolerances within .008", shank within .003 tolerance. Production rate, 300 per minute.

4 Leadwire . . . .026" soft tinned copper wire formed at a rate of 140 per minute with two 7/64" diameter windings.

5 Contact Part . . . .010" x 3/8" wide phosphor bronze formed at 175 per minute.

Nilson makes a complete line of versatile 4-Slides . . . accommodating wire diameters up to ½", feed lengths up to 32", and ribbon metal up to 3" width . . . with press capacities ranging to 75 tons.

Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogs . . . the first step to increased production.

A.H. NILSON MACHINE COMPANY

1522 RAILROAD AVENUE BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

CIRCLE INFORM-A-GRAM KEY NO. 28

. . . Month's Talk from Page 23

This change in practice could not have occurred without a change in attitude — without the emergence of a new confidence in the future. And on the other hand it is also true that *the new forward planning and investment by business helps in turn to reinforce the general confidence in the future which is so much a part of American life today.*

We have come to think of planning as the most important function of management, whether we are talking about business management or management of the nation's affairs. And the higher the level of management, the more exclusively preoccupied it must be with the shape of things to come. The fundamental responsibility of top business management is to make sure the long-range objectives of an organization are consistent with the long-term possibilities of the economy and the society in which the organization lives and develops.

This new emphasis on growth over the long pull does not mean, of course, that industrial management is unconcerned with more immediate problems or that it is unaware of the possibility of sudden reverses. Throughout the postwar period business generally has been cautious, with its eye out for signs of serious trouble. And this wary attitude has been a strong stabilizer. It has helped to prevent our prosperity from turning into a runaway boom.

Along with this healthy caution about the immediate future, however, present-day management has developed a new way of putting the present in perspective with the long-range future. It has come a long way from the storm-cellar philosophy of a generation ago when the tendency was to retreat and retrench at the first sign of bad weather. Its new attitude is one of responsibility to its own industrial community — to its employees, its shareholders, its suppliers, its dealers — all of whom are vitally interested in the soundness of the organization for the long pull and its potentialities for growth. And management knows that the way to carry out that responsibility is to plan for growth and to invest in growth.

The importance of confident long-range capital investment as a stabilizing and dynamic force in our economy has been demonstrated this year very clearly. With some very important segments of the economy, including the automobile industry, producing at lower rates than in 1955 and reducing their short-term expenditures, industry as a whole, again including the automobile industry, went right on building and equipping plants at the highest rate on record. It was this investment more than any

. . . *Continued on Page 42*

Why the Contract Shop Owner Prefers PRODUCTO Die Sets

They help protect his profits

The contract shop owner prefers Producto die sets because they help protect his die performance...his delivery promises...his profits.

The shop owner favors Producto because he can choose from a wide range of die set styles and thicknesses in steel, semi-steel or a combination.

He knows that when his dies are mounted in Producto sets, they will retain the precision built into them. He can expect maximum die life, maximum production with minimum press downtime for regrinding.

The shop owner likes the fact that Producto offers him a choice of two classes of precision, and that *he pays only for the amount of precision he buys.*

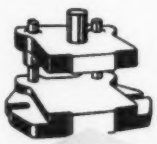
He knows that whoever handles the die will spend the least possible time taking it apart and putting it together because Producto's Qwik-Fit Guide Pins minimize die set assembly problems.

Most important, the shop owner can depend on efficient Producto service and strategically-located Producto distribution centers to protect the delivery promises he makes to *his* customers.

When the contract shop owner thinks in terms of protecting his profits, he thinks of Producto die sets and accessories. You should, too.

NEW DIE SET CATALOG No. 11 is another reason the shop owner prefers Producto. It makes selection and ordering really easy. Write for your free copy today. And ask to receive Die Set Digest, too.

THE PRODUCTO MACHINE COMPANY
970 Housatonic Ave., Bridgeport 1, Connecticut



PRODUCTO

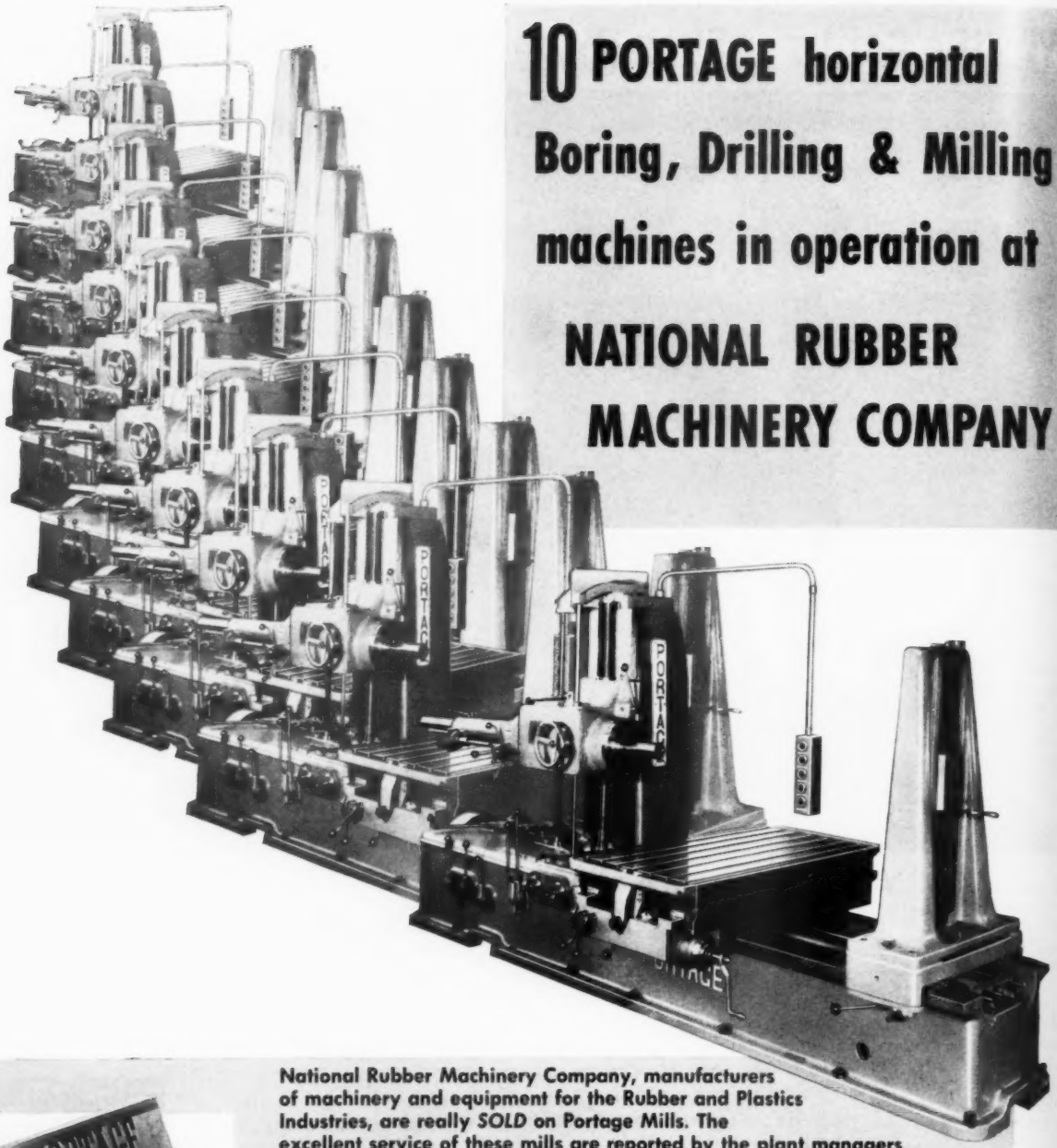
Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

CIRCLE INFORM-A-GRAM KEY NO. 29

10 PORTAGE horizontal Boring, Drilling & Milling machines in operation at NATIONAL RUBBER MACHINERY COMPANY



National Rubber Machinery Company, manufacturers of machinery and equipment for the Rubber and Plastics Industries, are really *SOLD* on Portage Mills. The excellent service of these mills are reported by the plant managers at Columbiana, Ohio and the Akron Division plant. This large installation certainly represents a vote of confidence for the performance of Portage Mills . . . and speaking of confidence . . . many leading manufacturers have come to realize that the ruggedness, versatility and low maintenance cost of Portage Mills makes them the best buy . . . and remember . . . their initial capital investment cost is less, without the sacrifice of quality. Write for complete information . . . TODAY.

THE Portage MACHINE CO.

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Representatives in Principal Cities

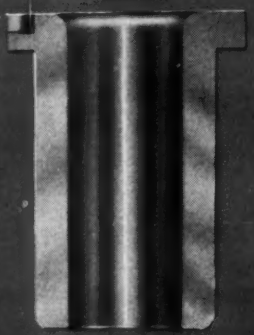
BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

CIRCLE INFORM-A-GRAM KEY NO. 30

for accuracy in your production
it pays to specify

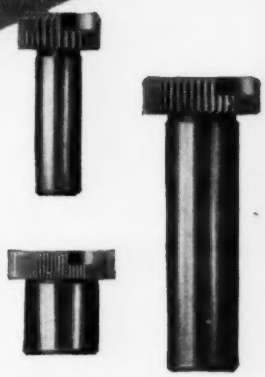
UNIVERSAL DRILL BUSHINGS

In Universal you get the best. Machined from finest quality steel. Blended radius on the top-inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip.



superfinish bores lengthen tool life

The superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum—especially in close tolerance work.



Standard sizes and lengths in stock for immediate delivery. Contact the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

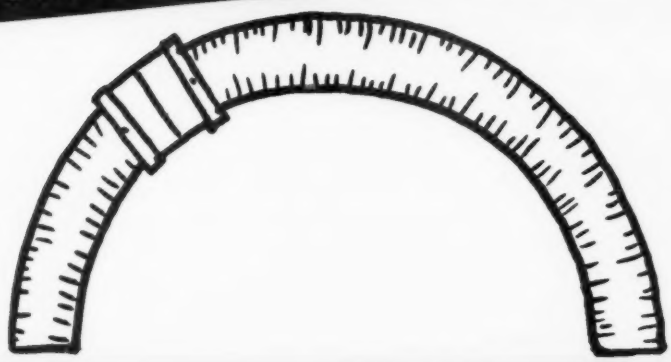
Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Micro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

UNIVERSAL ENGINEERING COMPANY | **FRANKENMUTH 8, MICHIGAN**

CIRCLE INFORM-A-GRAM KEY NO. 31

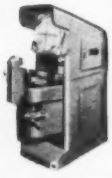
DROODLES

by ROGER PRICE



Bench Model BC-7D

Floor Model FC-30



Floor Model FC-14

"SLIDE RULE ON A BENDER"

This slide rule served my Uncle George well for years, until he gave up engineering to become a full-time horse player. His frantic efforts to figure an unbeatable system made the slide rule just another sad statistic, for it fell a victim of digit-alis. George's number was up, too, because between his wife and his handicapping, he was finally nagged to death.

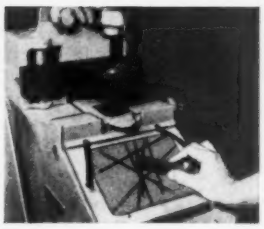
If *you're* being nagged . . . by difficult inspection problems . . . I can put you onto a sure thing. It's the J & L Optical Comparator, a marvelously precise inspection instrument that inspects and measures all sorts of parts and objects, in a range of sizes.

The J & L Comparator spurs production-line inspection, because it's *easy* to operate, is accurate to .0001", and is incredibly flexible and versatile. Eleven models available. Send coupon today for pay-off information.

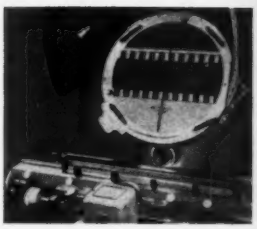
JONES & LAMSON OPTICAL COMPARATORS

Precise . . . Rapid . . . Flexible . . . Easy to operate

Checking keyway tolerances and hole diameter tolerances, as well as their locations and relationships to one another, in the same operation. Multi-base fixture allows rapid changeover for a variety of parts.



Statistical quality control of glass fibres is easy, using a vertical stage on the J & L Comparator. With 250X magnification, .001" shows as ¼" on the screen, and .0001" as .025". Each fibre is measured instantly to .0001".



Long racks or slotted bars are accurately inspected with the Adjacent Reticle Fixture. A precise scribed glass reticle provides rapid lateral indexing. Tolerance lines on the chart indicate variations in individual dimensions.

J&L JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 519 Clinton Street, Springfield, Vermont, U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete J&L line of optical comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____

CIRCLE INFORM-A-GRAM KEY NO. 32

PULLMAN-STANDARD FINDS MANY USES FOR STEELWELD PRESS

Model LS½-10 Steelweld Press making hutch frame parts for phosphate cars. Two parts are made at one time from ¼ inch plate, one for left-hand and other for right-hand of hutch. Note pins on male dies which remove parts from lower dies after forming.

A few of the many parts produced within a short period on the Steelweld Press. Curves and bends of every shape and degree are formed quickly and accurately.

"The more we use our Steelweld Bending Press, the more we learn about what it can do for us", said the Day Superintendent of Pullman-Standard Car Mfg. Co., Butler, Penna. "As a result it is handling more and more of our work. We are doing a great many forming jobs on it that did not occur to us as being possible when we first installed the machine."

An endless variety of parts are produced on this press. These are mostly of ¼ and ⅜ inch steel plate and involve curves and bends of every description for gussets, fulcrums, braces, frames, housings, etc. used in the manufacture of railroad cars.

The dies used are relatively simple and made in the company's shop. Because dies are easily changed, it usually takes about an hour to set up for a new job.

If you work with metal plate in any thickness up to one inch, for bending, forming or punching, you should get the facts on the many features of Steelweld Presses.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

8730 East 281 Street, Wickliffe, Ohio

STEELWELD

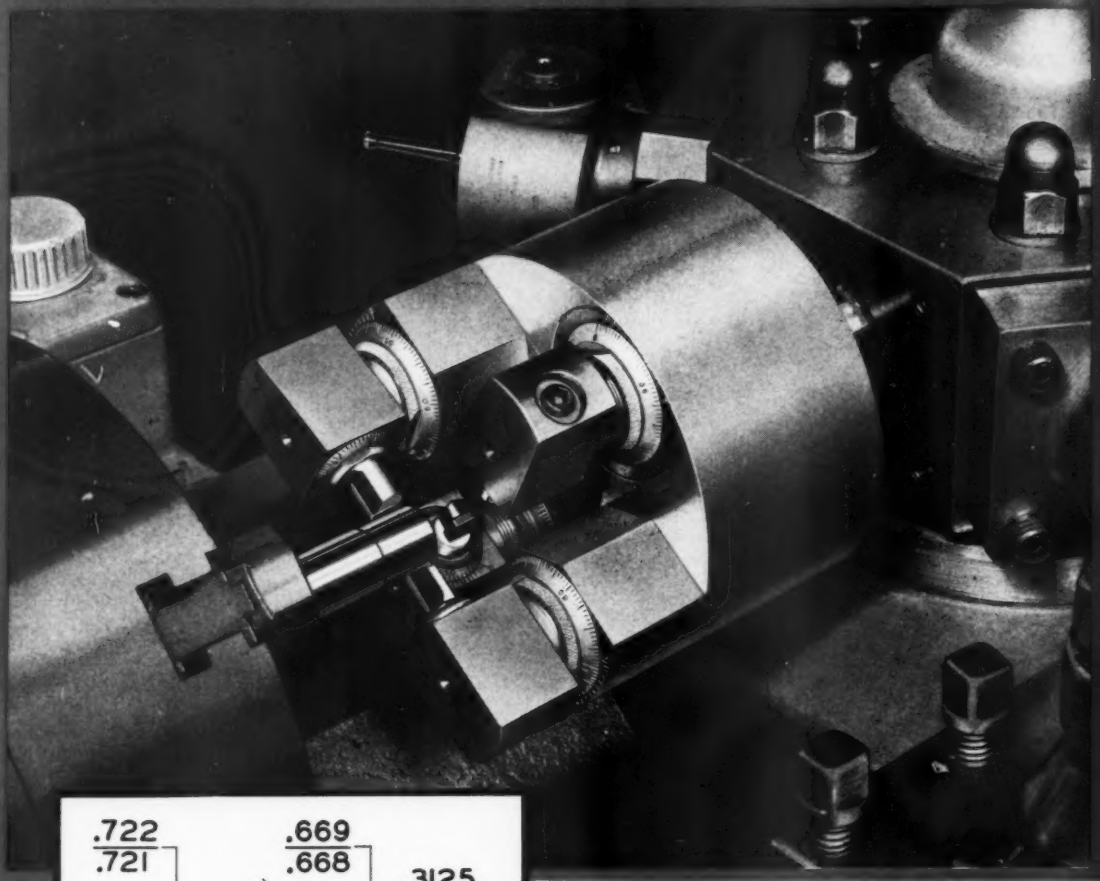
BENDING PRESSES

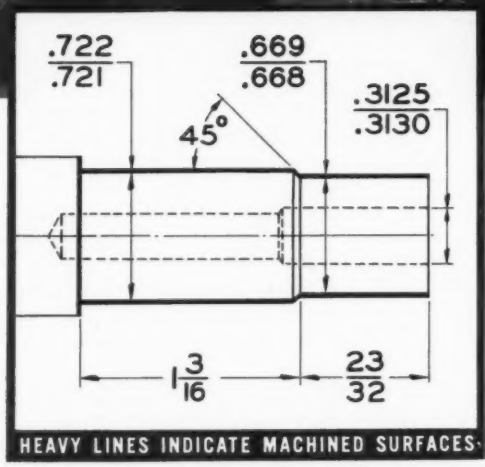
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

CIRCLE INFORM-A-GRAM KEY NO. 33

Microbore® PRODUCTION TOOLING

FOR PRECISION BORING, TURNING and FACING OPERATIONS





HEAVY LINES INDICATE MACHINED SURFACES.

Complete facilities are available for engineering and manufacturing special Microbore equipment for all types of producton operations.

Microbore Reduces Setup and Machining Times on Turret Lathe Operations

Rates of feed on turning operations were increased 100% by incorporating Box Turning Tool with multiple Microbore units.

Opposed Turning Tools are rapidly set for equally divided chip load by means of micrometer vernier adjustment provided at each tool station.

Each tool is adjusted independently by micrometer vernier principle for radial and linear settings which provide accurate and rapid settings of tools for shoulder dimensions and turned diameters.

SEND US YOUR TOOLING PROBLEMS

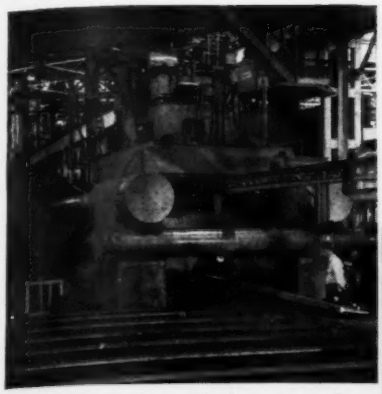
DE VLIEG MICROBORE

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 34

For the King and Queen of Extrusion Presses . . . it's FIRTH STERLING HOT WORK DIE STEEL



Giant press extruding an aluminum spar section.

2500 lb. die blanks and a finished extrusion die of Firth Sterling HWD Hot Work Die Steel.

At Kaiser Aluminum & Chemical Corporation's Halethorpe Extrusion Works, operated under a U. S. Air Force lease, are two 8,000 ton capacity extrusion presses—the largest operating units designed and built in the United States. Presently extruding large, complex aluminum shapes—wing spars, wing panel sections, and missile hull sections, for the aircraft industry, the two giant presses, named Rex and Regina, utilize dies made from Firth Sterling Hot Work Die Steel.

Yes, Firth Sterling HWD is a monarch in its own right, with properties capable of withstanding the tremendous pressures of this king and queen of extrusion presses. This intricate process requires materials that can operate continuously in volume production without replacement. These giant presses each weigh 1500 tons and are capable of extruding aluminum shapes more than 85 feet long and over 1200 pounds each in weight. The use of Firth Sterling HWD is tangible evidence of the high opinion modern die makers have of the quality of the material.

HWD Steel is just one of the Firth Sterling line of more than 50 Tool and Die Steels. Ask for a Firth Sterling engineer to cooperate in your next die making problem to assure the correct grade and analysis.

R-326

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MILLS McKEESPORT, TRAFFORD, DETROIT, HOUSTON, HARTFORD
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PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

CIRCLE INFORM-A-GRAM KEY NO. 35

Announcing . . .

METLFAX

METLFAX: a new, unique publication!

METLFAX: devoted exclusively to serving the metalworking industry!

METLFAX: first issue — November 1956!

METLFAX: a pocket-size 4¼" x 6" review publication devoted exclusively to metalworking PEOPLE • PLANTS • PRODUCTS • PROCESSES • PRODUCTION!

METLFAX: a pocket-full of metalworking information! Designed for redi-readability!

METLFAX: written to command the interest of design, engineering, tooling, production and management executives at all levels and in every phase of metalworking!

METLFAX: aims and objectives — to aid the entire metalworking industry in achieving maximum production at minimum costs!

METLFAX: capsule comments on all metalworking subjects, providing a previously non-existent coverage of the entire metalworking market!

METLFAX: over 75,000 copies! An initial controlled-circulation to more than 75,000 metalworking executives, by name and title, in every size and type of metalworking plant throughout the nation! Circulation list over four years in the making — 100% up-to-date!

METLFAX: offers the lowest per thousand full-page rate for reaching the entire metalworking field! Maximum metalworking coverage at an unbelievable low cost of less than $4.00 per page per thousand copies!

Closing date for the February issue is January 2, 1956. For full information, rates and details, address . . .

METLFAX

1975 Lee Road

Cleveland 18, Ohio

MAGNESIUM for low cost tooling

DOW

MAGNESIUM *machinability beats tight schedules*

Machinability and handling ease are two reasons Carr Lane moves jobs faster, at lower cost, with magnesium tooling plate

When a job has to be completed in a hurry, which is often the case at Carr Lane Manufacturing Company, St. Louis, there are big advantages in using magnesium tooling plate.

FASTER MACHINING. Production operations go faster because magnesium jigs and fixtures are easy to machine, easy to weld. Excellent dimensional stability and precision flatness help to hold the closest tolerances. These properties also help to save many hours in the process. On the fixture illustrated, it would take twice as long to do the job in aluminum—and ten times as long in steel.

FASTER HANDLING. The light weight of magnesium, two-thirds that of aluminum, permits pieces to be handled and moved from one operation to another with a minimum of time, effort and equipment. This is particularly important with large jigs and fixtures which couldn't be handled manually if they were made of steel.

FASTER AVAILABILITY. You can get magnesium tooling plate when you want it and how you want it. Whether production deadlines are tight or not, it's always readily obtainable in any standard size and gauge from stock. Contact your nearest supplier of Dow Magnesium or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 372AA-1.

Available from stock at . . .

Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Co., Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

you can depend on DOW MAGNESIUM DOW

CIRCLE INFORM-A-GRAM KEY NO. 37

3 Kwik-Chek adjustable Hole Gages can replace over 700 "Go" and "No-Go" Plug Gages

HAMILTON

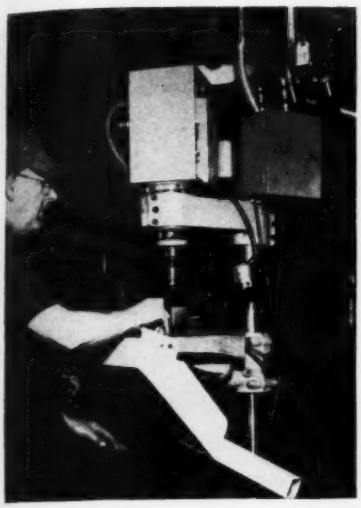
KWIK-CHEK gages adjust instantly to any diameter reading from .025" to .380" . . . accurate to .0005" . . . and lock at *precise* diameter readings.

KWIK-CHEK gages (priced at $40 each, or $115 for the set), are used by tool engineers, machinists, and inspectors. Crystal reading magnifier and easy adjustment—5 seconds or less per reading—make them ideal for use by non-technical workers, too.

Write for name of Kwik-Chek sales agent nearest to you

HAMILTON WATCH COMPANY • ALLIED PRODUCTS DIVISION, LANCASTER, PENNA.

CIRCLE INFORM-A-GRAM KEY NO. 38



Unique Head on Drill Press Speeds Production 2½ Times

Drilling 5/32" holes 3/8" deep, in tough forged rivets is a requirement in the production operations of the Bradley Washfountain Company, Milwaukee, Wisconsin.

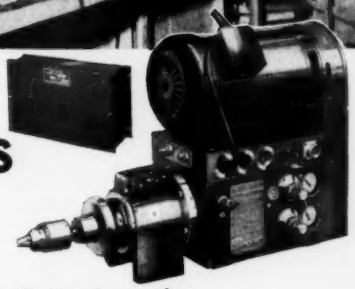
Former methods produced only 125 pieces per hour with very high drill breakage due to the hard stringy metal. How to reduce drill breakage and increase production was an ever present problem with this manufacturer.

New Head Tried

In an attempt to solve it, a special automatic drill unit, with all operating and control mechanisms built-in, was set in place of the standard head on the drill press regularly used for this work. A cycle timer and unloading chute were added to complete the new set-up. Note the special mounting bracket, an accessory supplied by the manufacturer, used to secure the new drill head to the standard drill press column. Because more accurately controlled precision feeds and speeds are possible with this new drill head, these remarkable new production results were achieved:

1—no drill breakage
2—333 pieces per hour—
2½ times former production
3—lower unit cost

This unique drill head is a completely new and different production tool. It is the Dumore Automatic Drill Head, Series 24, designed for single or multiple unit operations where versatility and flexibility are necessary to meet the varying conditions and frequent changeovers of diversified manufacturing. In this case, it proved its worth on one set-up. When desired, it can be moved quickly and easily to numerous other operations with minimum time loss. For further information about this and other automatic precision tools for greater production possibilities at lower cost, write to The Dumore Company, 1304 Seventeenth Street, Racine, Wisconsin.



PRODUCTION RUNS *doubled*

with this New 2-in-1 tool
the DUMORE Series 28 Automatic
"DRILL-N-TAP" UNIT

A large aircraft parts manufacturer uses a bank of 9 "Drill-N-Tap" Units, mounted on standard drill press columns, to get twice as much production per hour at lower cost, over hand methods. This combination set-up handles hundreds of small and large drilling and tapping operations daily. Drill brushings are simply removed when tapping. Tap fits into chuck, no extra head is required. *A flip of the switch controls tapping or drilling.*

This company also uses over 40 Dumore Series 24 Drill Units for all types of production drilling operations. They find that these automatic machines further help to cut costs and speed output all along the line.

A *driller* and a *tapper* . . . all in the same tool . . . at the cost of only one!

It drills or taps without attachments with less tool breakage and scrap losses. No long overhang, or expensive clutches to wear out. Self-reversing motor, electrically controlled, withdraws tap by reversing spindle rotation. Work mounts close to fixture with little tool travel for faster cycling, less idling time.

Mounts in 3 minutes —anywhere — with simple nose mounting bracket, on job after job for production runs in the high thousands or low hundreds. 10 speeds from 265 to 4900 rpm standard.

Available as complete Drilling and Tapping Press with fixture, press and "Drill-N-Tap" Unit, or, "Drill-N-Tap" Unit supplied with bracket to convert your 14" x 17" drill press into a completely automatic drilling and tapping machine.

GET A DEMONSTRATION NOW . . . SEE YOUR DISTRIBUTOR, OR WRITE

YOU CAN DO MORE WITH DUMORE DRILL UNITS
DRILLING • TAPPING • BORING • MILLING • FACING • REAMING • CHAMFERING • DEBURRING

DUMORE®
PRECISION TOOLS

AUTOMATIC DRILL UNITS
TOOL POST AND HAND GRINDERS

1304 Seventeenth Street, Racine, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 39

People who know

Anocut electronic control and electrolytic equipment can be installed on any good quality standard grinder; surface grinder, offhand, face, rotary, cylindrical, I.D., etc.

Here shown is a Gallmeyer and Livingston No. 15 surface grinder converted for use with Anocut electronic controls and equipment. Operator adjusts depth of wheel to set for plunge grinding of chip breakers. **(Photo courtesy—Pratt & Whitney Aircraft)**

Chip breaker cuts 3/4" long x 1/8" wide and .015" deep are made by the Anocut process in one pass in 8 seconds.

ANOCUT
631 WEST WASHINGTON •
The Electronic "plus" in Grinding

most about tool grinding costs are our customers!

We find it easy to explain the Anocut process to people who have a lot of carbides to grind — those who really know tool grinding costs — like carbide manufacturers and large metal-working plants.

They know, through intensive cost control experience, that tool grinding costs can be a too-big part of factory burden . . . and that's why so many of them have been rapid converts to our Anocut electrolytic grinding process.

Here's the ABC of tool grinding economy — as they've proved it . . .

FIRST . . . Reduce unit abrasive costs. Until they are at a minimum all other efforts in cost reduction will be in vain.

Our Anocut process provides lowest wheel costs — whether you're using green grit silicon carbide or diamonds. Our process removes 90% of the metal electrolytically to extend wheel life often as much as 10 to 1.

SECOND . . . Eliminate waste in fixturing, set-up and gauging.

Even where there is a wide variety of tools there is opportunity for ingenuity in developing fixtures, protractors, etc. that will pay big dividends. Anocut does the job in one operation — usually in a single pass to full depth — so fixturing and set up are simplified, handling is speeded. Anocut combines the roughing and finishing operations into one. Our engineers regularly assist our customers to accomplish these improvements.

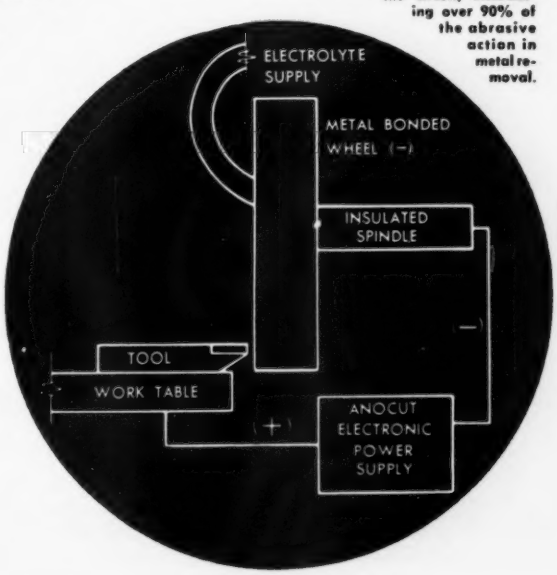
THIRD . . . Increase grinding speed to minimize "time on wheel."

Anocut provides an economical speed that is faster than good practice with conventional grinding. Anocut is fast, but until abrasive and fixture costs are under control, you can actually increase total cost by increasing speed.

It is likely that Anocut equipment can make important savings for you. If it can, we'd like to serve you. If not, we'll be the first to tell you. Remember, you don't have to be big to save big money.

Write — or call collect for descriptive literature.

Please do not confuse Anocut with the "spark-arc" or any other electric machining method. The Anocut process removes metal by electrolytic deplating of the workpiece. The tool or part to be shaped is the anode (+) and the metal-bonded grinding wheel is the cathode (−). The electrolyte (coolant) completes the circuit, eliminating over 90% of the abrasive action in metal removal.



Engineering Company

CHICAGO 6, ILLINOIS • PHONE: STATE 2-5480

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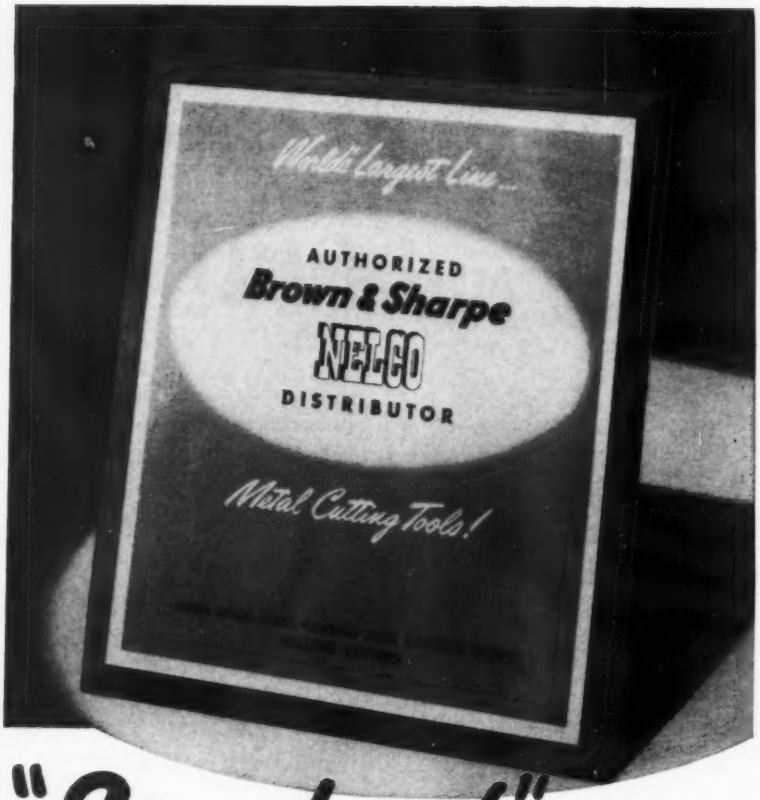
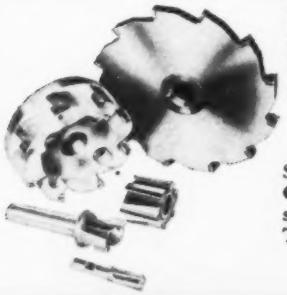


"Standard" MILLING
CUTTERS BY THE THOUSANDS!
... from stock—through your
Brown & Sharpe—NELCO distributor!

Brown & Sharpe - NELCO—manufacturing over 3000 Carbide, Carbide Tipped and High Speed Steel milling cutters and accessories—stand behind the distributor displaying this plaque.
You can rely on him to save you days and dollars with superior tools, superior service!
Use the tools that really give you a COMPLETE selection . . . a speedy solution to all your cutter problems—over 3000 "standards" are as near as your phone. Switch to the most complete source! See the Brown & Sharpe-NELCO Distributor in your area . . . today!



SEND for the New Nelco Catalog just off the press, showing over 700 Carbide Tipped Cutting Tools.

NELCO TOOLS
For that EXTRA Edge in Production!
NELCO TOOL COMPANY, INC. • MANCHESTER, CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 42

. . . Month's Talk from Page 28

other single factor that enabled the economy to make its "rolling adjustment" and go on to set new highs in national production and income.

Through its investments in research and development and in new tools of production, American business will continue to add a major dynamic force to the forward drive of the economy. To carry on this vital function with the greatest effectiveness, business needs the broad support of the American people. People are far better informed today than they once were about the many contributions of business to their lives. No one needs to be told any longer that the thousands of new products and services being developed by industry every year create new jobs and add to the pleasure of living. And no one needs to be told that prosperous business is basic to a prosperous country. But millions of people could realize more clearly than they now do that when industry invests in more productive and more automatic machinery it is helping to bring more products within the range of more pocketbooks, helping to create more leisure in which to enjoy better living, and helping to control inflation, which is an ever-present danger in an expanding economy. This kind of understanding would provide a broad base of support for the kind of forward-looking governmental policy on private capital investment that I am going to suggest in a few minutes.

In addition to getting the understanding and support of the general public for the vital importance of its capital investment programs, it is essential for industry to get increasing understanding from labor. Over the past few years it has been gratifying to read the progressive statements made by labor leaders on the meaning of the technological advances which are being made in the American factory. And more specifically, it has been gratifying to note that in all the recent statements by labor leaders on the subject of automation there has been no attack on automation as such and no suggestion that management take steps to slow down its development.

There is real evidence that labor leaders understand the basic importance of capital investment to the working man — and the need for keeping wage demands reasonably related to increases in productivity. As an illustration of what I mean, here is a sentence which appeared in a recent issue of "Economic Trends and Outlook," published by the AFL-CIO Economic Policy Committee:

"Certainly it is true that if real wages are to rise there must, indeed, be a constant increase in productivity as well which, in turn, can make possible a rapid growth in the total size of the production pie."

. . . Continued on Page 46

Get to the POINT... *in a hurry!*

with

PRATT & WHITNEY *Electrolimit* JIG BORERS

The point we'd like to make is that Pratt & Whitney Electrolimit Jig Borers incorporate an exclusive method of locating the table that is *unbeatably* fast and convenient . . . and accurate to .0001".
Thanks to the P&W Precision Preloaded Ball Roll Quill, you'll be able to retain original accuracy and rigidity *indefinitely* without any adjustment or maintenance.
And there'll never be any loss of accuracy from wear.

NOW . . . Pratt & Whitney Electrolimit Jig Borers can also be furnished with positioning control by NUMERICAL DATA.

. . . COMPLETE LINE includes table sizes from 12"x24" to 36"x72".

Write for free copy of P&W Electrolimit Jig Borer Circular No. 587 . . .

ALSO FURNISHED . . . a full line of Pratt & Whitney End Measure Jig Borers which also deliver "tenths" accuracy year after year.

PRATT & WHITNEY COMPANY
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15 Charter Oak Boulevard, West Hartford, Connecticut
Representatives in Principal Cities Throughout The Country

MACHINE TOOLS · GAGES · CUTTING TOOLS

X.F. Swiss Pattern 65-Gauge 3" Broach file—one of the smallest Nicholson-made files

18" Mill Bastard—one of the largest files made by Nicholson

From micro-mechanics to forgings . . . there's a Nicholson or Black Diamond file for every purpose

You may not finish miniature dies or components by hand in your plant. And you may not dress huge forgings. But there's a Nicholson or Black Diamond file that's exactly right for each of these uses—and for every file use in between.

Depending on the job at hand, you can select X.F. (EXtra Fine) Swiss Pattern files in hundreds of shapes and sizes . . . Special Purpose files for aluminum, brass, lead, stainless steel, and other metals and plastics . . . Machinists' files, Regular Purpose files and rasps . . . from more than *six thousand* consistently high-quality Nicholson and Black Diamond varieties.

Your Nicholson or Black Diamond catalog will show you the wide choice of files and rasps available. And you can learn a lot about file selection, care and use from "File Filosophy," an interesting, profusely illustrated book that's yours for the asking.

If you happen to have an unusual filing problem, your industrial distributor is likely to have the solution. He's an expert with a specialized knowledge of industrial equipment and processes. So call on him for professional advice as well as service.

Always specify Nicholson or Black Diamond brand

NICHOLSON FILE COMPANY, PROVIDENCE, RHODE ISLAND
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A FILE FOR EVERY PURPOSE

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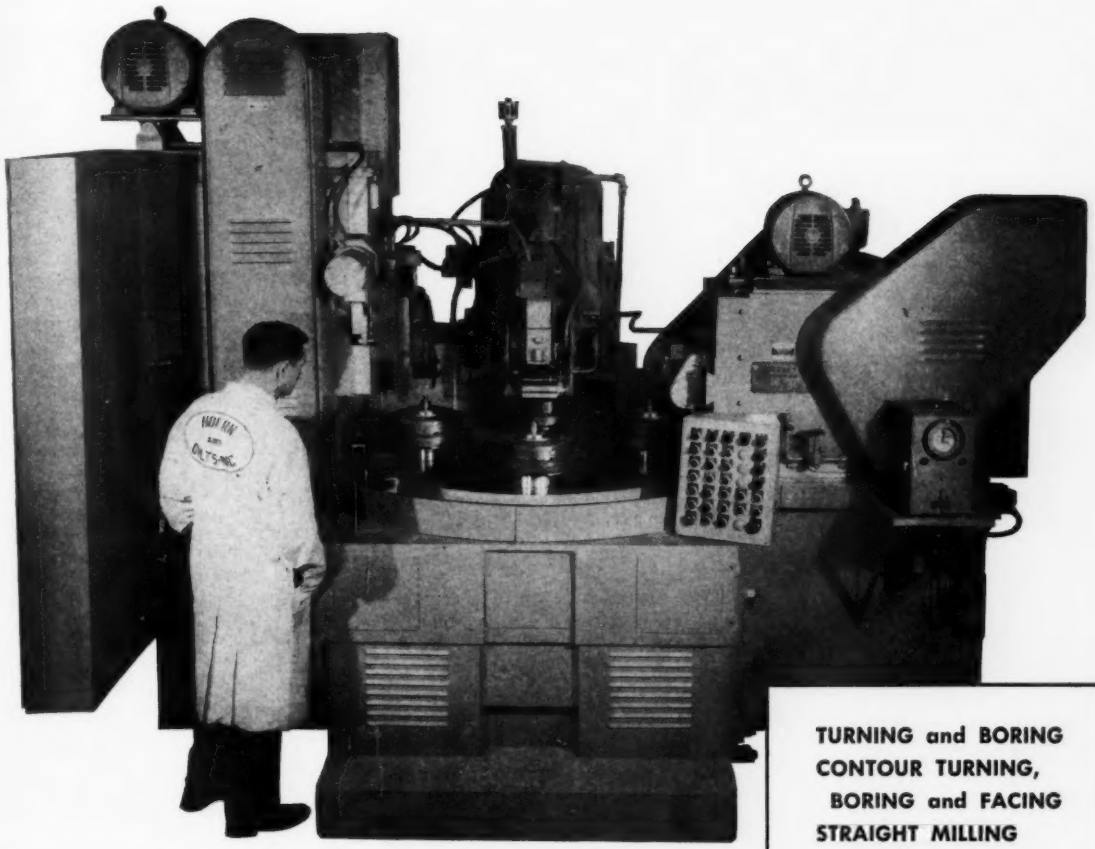

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CONTOUR TURNING, BORING and FACING
STRAIGHT MILLING
CONTOUR MILLING
PLANETARY MILLING
I. D. GRINDING
O. D. GRINDING
SURFACE GRINDING
SURFACE HONING

You can combine these finishing operations on one Hoern & Dilts indexing finishing machine →

Indexing Table: Mounted on pre-loaded roller bearings. Index accurate to .0002". By providing adjacent spindles with proper chucking devices, *both ends* of a piece may be put through identical or closely related operations.

Heads: Individually cam-actuated heads, each designed for a specific type of operation which may be performed vertically or horizontally as required. Heads self-contained, with individual electrical, pneumatic and lubricating systems.

Speeds: One over-all speed may be used, or a different speed at each station. Spindles may be stopped and locked in any predetermined position at any station.

Feeds: Individually adjustable for each head.

Grinding Operations: Wheels dressed and compensated during index.

Automatic Gauging and feedback adjustment available at all stations.

A Hoern & Dilts Indexing Finishing Machine handles with *one* chucking and one operator, the operations ordinarily performed by several operators using completely different types of equipment.

This advanced approach to increased, more accurate production is accomplished by arranging a variety of self-contained heads around a central indexing table in which the spindles are mounted. Since all the operations are performed with a single chucking, all the proper relationships are maintained.

Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

The New Britain Machine Company
Saginaw, Michigan

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS:

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Precision Horizontal Boring, Drilling and Milling Machines

CIRCLE INFORM-A-GRAM KEY NO. 45

KALAMAZOO

...worth more to you

MODEL 8CW

If you are interested in cutting costs and increasing production—maintaining extreme accuracy with the latest designed horizontal metal cutting band saw machine – write for complete details or contact your local Kalamazoo distributor.

MACHINE TOOL DIVISION

Kalamazoo TANK and SILO COMPANY

1215 HARRISON STREET . . . KALAMAZOO MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 46

. . . Month's Talk from Page 42

At a time when the pressures of inflation constitute a problem which is a matter of national concern, recognition by labor organizations of the necessary relation of wages to industrial productivity is constructive and helpful.

Of key importance in encouraging industry to continue investing in new plants and up-to-the-minute equipment is the attitude of the federal government. *The tax laws and the policies of those who administer the laws have a direct bearing upon the ability of industry to obtain sufficient financial resources to keep pace with the rapid advance of technology.*

The three main sources of funds for expenditure on plants and equipment are loans and equity capital, retained earnings, and depreciation reserves. To meet its capital needs industry draws upon all three of these sources. In our economic system it is particularly important that industry take full advantage of borrowed funds and equity capital, which represent the savings of the public. Wide participation of the public in the growth of industry through the medium of loaned funds and stock ownership has come to be one of the most vital features of modern capitalism. Sound fiscal and monetary policies of the government can help to keep this source of funds flowing to the mutual benefit of industry and the public.

It must be recognized, however, that depreciation reserves and retained earnings have long been industry's major sources of funds for new plants and equipment. In fact, *two dollars out of every three now being spent to keep industry as a whole up to date and competitive with the rest of the world in its productive facilities come out of depreciation allowances alone.* In the automobile industry, incidentally, this source is providing only about one out of every three dollars being invested in new plant and equipment — and in recent years there has been large-scale borrowing by the automobile companies to meet their capital needs.

One of the principal reasons for the continued high capital investment by industry as a whole during the last few years has been a new understanding by government about what can be accomplished for the general good of the country by liberalizing depreciation allowances on new plants and equipment. This new understanding is not the exclusive possession of either political party. It was used in World War II to expand defense facilities — and since the start of the Korean War in 1950 it has been used again to encourage the rapid building of more than $36 billion worth of new facil-

. . . Continued on Page 52

DIFFICULT JOBS ARE *routine on* DE VLIEG SPIRAMATIC JIGMILS®

PHOTO COURTESY OF DANROY BORING CO.

DeVlieg *SPIRAMATIC* JIGMILS permit accurate machining of workpiece from 4 sides at 1 setting!

The above photograph, taken in a well known Detroit Tool Shop, illustrates a Special Hydraulic Fixture being machined on a DeVlieg Model 3B-48 *SPIRAMATIC* JIGMIL. This job was completely machined on four sides at one setting to precise limits of accuracy and operations included drilling, boring, milling and O.D. turning 22" diameter trunnion.

Come to Detroit...

See a practical demonstration of the JIGMIL Technique

DE VLIEG MACHINE COMPANY

450 Fair Avenue, Ferndale • Detroit 20, Michigan

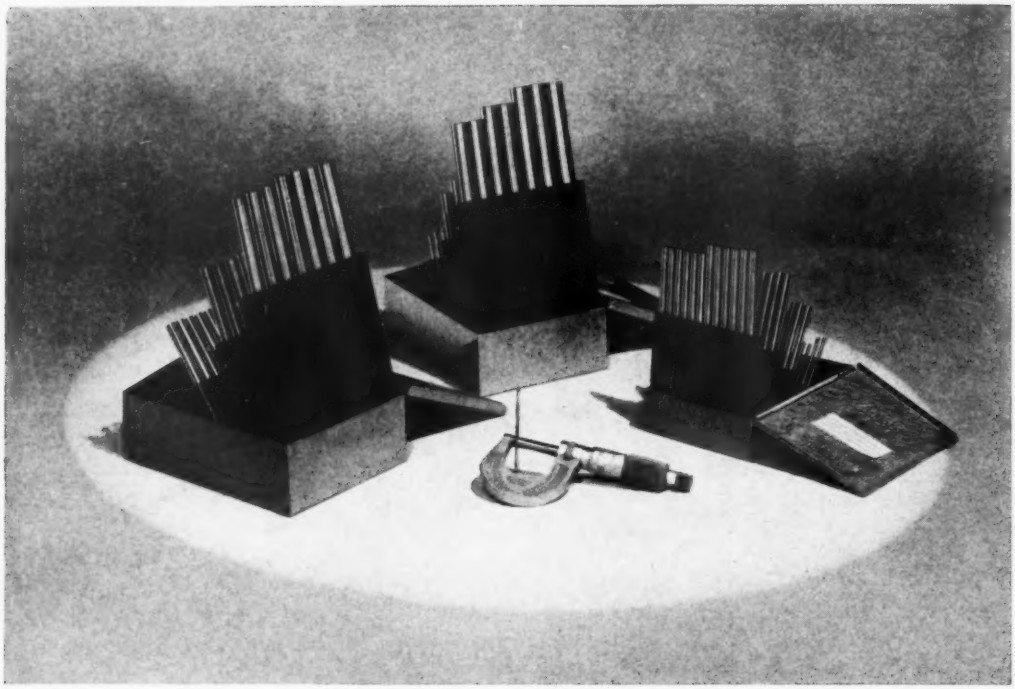
CIRCLE INFORM-A-GRAM KEY NO. 47

DRexel 6-4222 ESTABLISHED 1927

WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS



115 Pieces – COMPLETE – .040" to .500" – $88.00

JOBBER SET	LETTER SET	WIRE SET
$32.27	$29.03	$27.40
in Huot Index	in Huot Index	in Huot Index

(PRICES SUBJECT TO QUANTITY DISCOUNT)

HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish.

parallel ground +.0002 —.0000

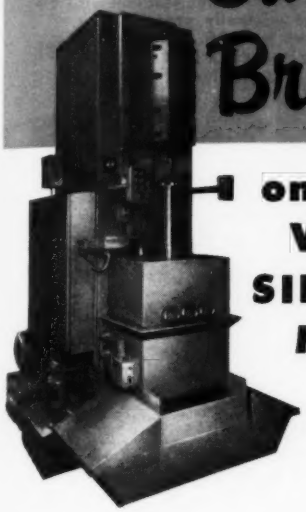
ANY DECIMAL DIAMETER OF STANDARD LENGTH .020" TO 1.000" SHIPPED ON 24 HOUR NOTICE

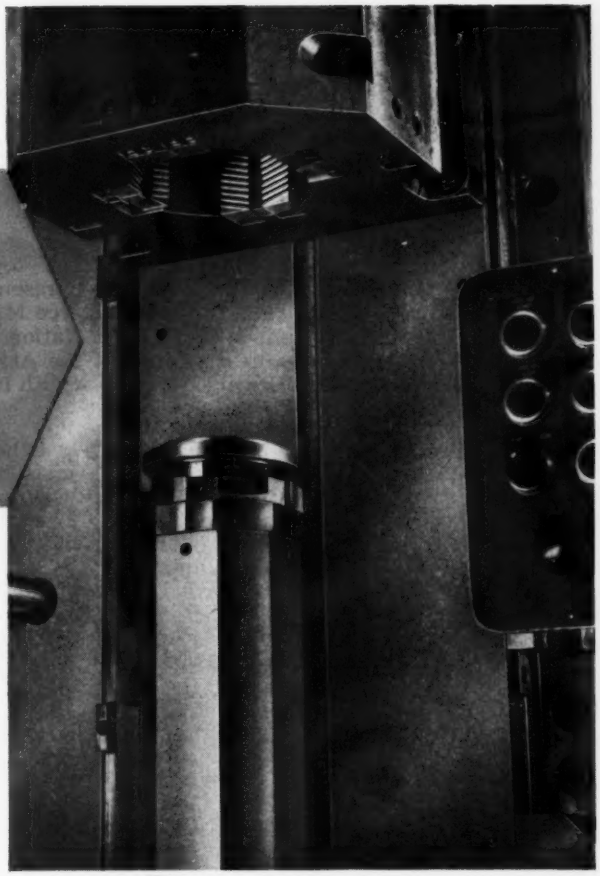
CIRCLE INFORM-A-GRAM KEY NO. 48

UNUSUAL TOOLING SETUP FOR

External Surface Broaching

on DETROIT VERTICAL SINGLE RAM MACHINE

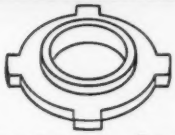




This broaching job requires rigidity and perfect alignment . . . which makes it a "natural" for the massive Detroit Vertical, built and tooled by experts. Note the safety feature which prevents the main slide from descending until dual push buttons have been operated. This slide holds the heavy, pot-type broach holder in perfect alignment with the fixture post, which is mounted on a fixed knee for even greater accuracy.

Detroit Vertical Single Ram machines are available in standard capacities from 5 to 25 tons, stroke length from 30″ to 90″. Interchangeable knees with shuttle table mechanism can readily convert this machine into a standard for future production needs. Oversize platens on all standard models allow multiple as well as single station tooling.

Detroit builds every size and type of broaching machine, automates and tools them to fit your needs. Call in a Detroit field engineer, or send us details of your production problem . . . today.



PART—**Automotive transmission component.**

OPERATION—**Broach 4 external lugs, equally spaced.**

TOOLING—**Pot-type broach holder, built in sections for convenient tool assembly . . . in perfect alignment with fixture post.**

CYCLE—**Operator loads work over fixture on top of post, starts machine. Broach holder descends with ram and bottoms after cutting stroke. Operator unloads work and presses palm button for return stroke.**

PRODUCTION—**120 parts per hour.**

MACHINE—**Detroit 10-ton Vertical Single Ram Broaching Machine with 42″ stroke and fixed knee.**

Write for new free bulletin on Detroit Vertical Single Ram Machine

DETROIT BROACH & MACHINE COMPANY

DEPARTMENT E-12

ROCHESTER, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 49

MANUFACTURING MEMOS

Honors . . .

● The Howard Coonley Medal was presented to Frederick S. Blackall, Jr. of Taft-Peirce Mfg. Co. The award was made at the Seventh National Conference on Standards sponsored by the American Standards Association in conjunction with its 38th annual meeting.

● Peter E. Rentschler recently received the Gold Medal of the Gray Iron Founder's Society, the association's highest award. He was honored for leadership in progressive foundry management with particular reference to good housekeeping and safety practices, and improved industrial public relations. Mr. Rentschler is president of The Hamilton Foundry & Machine Co.

Engineering Group Formed . . .

● AC Spark Plug Division of General Motors Corp. has disclosed the formation of an engineering group to develop pneumatic-powered components for the automotive industry. The group will be headed by Gordon W. Harry, staff engineer.

Awards . . .

● Entries for the 1957 John Woodman Higgins Redesign Award are now being accepted. The annual award offering a $500 prize, will be based on successful redesign indicating originality of design and significant cost savings realized in the changeover to the metal stamping process.

● Gregory Industries, Inc. has announced the establishment of a $1,500 cash award. It will be presented annually for the most outstanding contribution to the further development of electric arc stud welding. The winner can choose between the cash award or $2,000 in scholarships for any individual or school.

● A "Monument to Courage" has been dedicated by General Electric Co. The monument is the 5000-kw vertical steam turbine-generator unit which was put into service at the Fisk Station of Commonwealth Edison Co., Chicago, in 1903. When installed, the unit was the world's most powerful electric power generating machine.

● Kaiser Aluminum & Chemical Corp. has purchased the extrusion plant of Hokin Aluminum Co. located at Dolton, Ill. Acquisition of this plant will enable the company to speed up by approximately two years its planned mid-West extrusion expansion program announced last year.

Crucible Steel Co. of America has acquired the entire interests of National Research Corp. in Vacuum Metals Corp., which now becomes a wholly-owned Crucible subsidiary. Vacuum Metals Corp., the country's first commercial producer of high vacuum cast metals and alloys, was originally organized by National Research in 1946. Since 1954, when Crucible purchased a 50% interest, it has operated as a jointly-owned firm.

◆

Reorganization necessitated by expansion of facilities and the creation of a new automotive division, has been announced by Detroit Harvester Co. Ray Hohman is serving as vice president in charge of the new automotive division. John Brooks has become vice president and general manager of the Implement Division and Allan W. Greene, vice president in charge of the Moto Mower Division.

◆

The fixed assets of Dibb Mfg. Co. have been bought by The Electric Storage Battery Co. The newly acquired company is a 30-year-old metal stamping, forming and fabricating firm. Its assets will be absorbed into Electric Storage Battery's Jordan Electric Products Division.

◆

Vac-U-Lift Co. is the new name of Blakeslee Mfg. Co. of Salem, Ill. This company has also made known their association with Hufford Machine Works, Inc., a California firm, of which they have become a division.

◆

Thomas Hydraulic Speed Controls, Inc. has purchased Aircraft and Automotive Products, Inc. The two firms will operate as separate entities with no change in company name, each maintaining and adding to its present line of products. The merger will afford a complete range of manufacturing facilities for machined metal products.

◆

A group of industrialists headed by Thomas W. Gulley, has purchased City Machine & Mfg. Co. The firm is Cleveland's major pioneer manufacturer of large equipment for steel mills and blast furnaces. Mr. Gulley has been named president and treasurer of the company.

AVOID the **HIGH COST** and difficulty of fabricating long, hard & straight parts by conventional methods . . .

THOMSON

60 Case

hardened and ground

SHAFTS, ROLLS, GUIDE RODS and other long-round parts

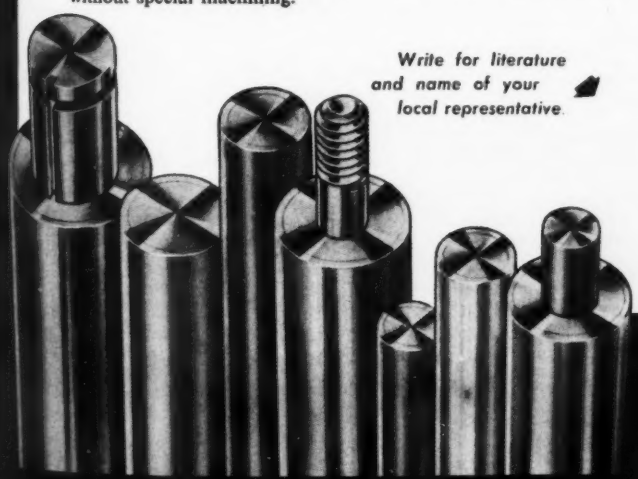
60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.

Write for literature and name of your local representative



ADVANTAGES of *60 Case*

- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

THOMSON INDUSTRIES, Inc.
Dept. C1, Manhasset, New York

Big Barrel for better balance, easier reading. Genuine Chrome Clad finish.
Choice of Ratchet Cap, Friction Thimble or direct feel.
Choice of plain or carbide tipped spindle and anvil faces.
One-piece spindle with precision ground threads.
One-piece barrel and frame. Single boring provides exact spindle and anvil alignment.
Exclusive new cam lock optional.
Tapered Compression nut.
Choice of genuine Chrome Clad or slip-proof black crackle frame.
WHY
LUFKIN
Micrometers give longer, more accurate service

1. TROUBLE-FREE DESIGN

Lufkin micrometers combine precision craftsmanship, the finest materials, and constant improvement in engineering. The taper design of the compression nut is just one example of the engineering thought put on every component.

2. EASY ADJUSTMENT

When anvil and spindle faces become worn, adjustment takes only a few minutes and *reading line retains its original position.*

3. WIDE CHOICE OF MODELS

Every personal preference, every job requirement can be met in the complete range of sizes and models in the Lufkin line.

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- His knowledge of new tools and methods will help you operate at peak efficiency.

417

CIRCLE INFORM-A-GRAM KEY NO. 52

. . . Month's Talk from Page 46

ities important to the national defense. We are fortunate today to have those facilities and the resulting increased capacity for peacetime as well as defense purposes. As a result of far-sighted tax legislation and administration the government was instrumental in adding to the nation's strength and widening the range of opportunity for workers and businessmen.

For too long a time people have talked about taxation in negatives. It has been mentioned in the same breath with poverty, death, and tyrannical government. It is true that the power to tax is the power to destroy. But in a broad sense it is also the power to give men the incentive to explore, discover, create and advance. The depletion provision of the tax law as it applies to oil is an excellent illustration of the way taxation can be used positively to add to the nation's total wealth. Used in such a way as to keep in proper balance the incentives of individuals and the sound progress of the country as a whole, *tax laws and tax administration can tap the greatest of all resources — the will of men — and put it to work in the nation's interest.*

The Revenue Act of 1954 made a big advance over previous tax legislation by authorizing industry to write off more rapidly than formerly the cost of new equipment. This legislation went a long way toward gearing our government's policies on depreciation allowances to the realities of the present age of accelerating advance in science and technology.

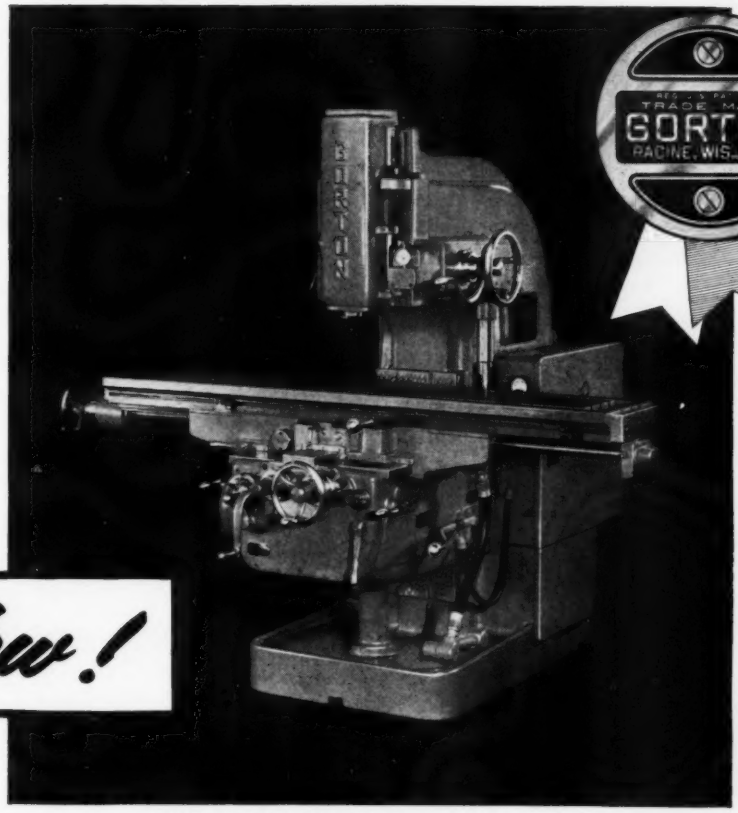
Now that this progressive legislation has been put on the books, it is to be expected that the government will begin to take a more realistic attitude in administering the law. The Internal Revenue Service now has a wide latitude of discretion in deciding how long a given piece of new equipment can be expected to last before it wears out or becomes obsolete. And presumably it is becoming more realistic than it was a few years ago in exercising this judgment.

I think all of us here today would agree that the principal fact governing the depreciation rate of modern industrial equipment is obsolescence. Most productive equipment in the present-day mill, factory or refinery becomes obsolete before it wears out. *The life of machinery today is determined by the pace of technological progress — not by the length of time it takes to tire out a piece of iron.* Government officials are beginning to recognize this fact more and more. But they are not as yet giving it due emphasis in their decisions.

Neither are they recognizing that it takes far more money to buy these fabulous new machines than it did

. . . Continued on Page 54

GORTON PRESENTS A *Winner!*



NEW GORTON 3-48 VERTICAL MILL

Compare These Features 〉 with any No. 4 Milling Machine

- Designed for high-speed and carbide milling
- 76-inch table; 48-inch table travel
- 46-inch saddle with hardened wear plates at each end
- 24½-inch Fullwidth knee
- 15/7½ H.P. spindle motor — drives spindle only
- 5 H.P. feed motor
- 36 speeds; 25 to 2,000 R.P.M.
- 3 Feed Ranges available
- Square-Lock bearing guides with long length-to-width ratio
- Dial-type horsepower load meter
- Interchangeable Assembly unit construction
- 100% mechanical and electrical overload protection
- Removable coolant pan for easy clean-out

Above features also available in Horizontal and Universal models.

Write for Catalog 2585, which describes 3-48 Vertical Mills, and 1212-1655 Gorton General Catalog.

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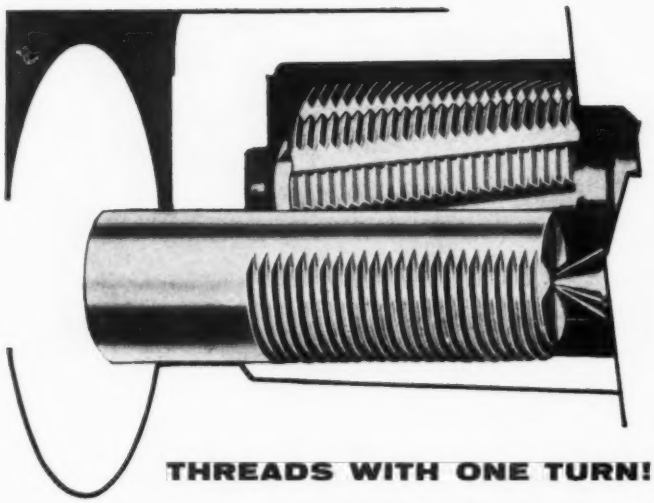
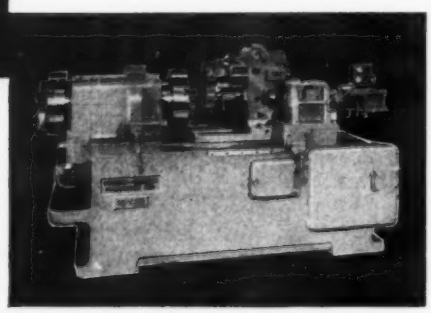
CIRCLE INFORM-A-GRAM KEY NO. 53



THREADS WITH ONE TURN!

Hanson-Whitney Thread Milling Machines* produce threads with approximately one revolution of the work. Unusual versatility . . . cutting internal, external, straight or taper, left or right hand threads. An exclusive cam design eliminates back lash . . . provides complete automatic cycle for lead, depth, rapid retraction for gaging or loading. Hanson-Whitney **single source** engineering and manufacture of machine tool, cutting tools, fixtures and gages for screw threads, assures production precision. Consult Hanson-Whitney engineering service, always available in the field or at home offices.

*Available — larger sizes and/or special cycles; automatic loading — rough and finish cycle; extra length beds, oversize swings.



Standard models available in
4" x 9" (hydraulic)
8" x 16"
10" x 24"
15" x 30"

Write for further information and literature

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TAPS • THREAD GAGES • HOBS • CENTERING MACHINES • THREAD MILLING MACHINES AND CUTTERS
CIRCLE INFORM-A-GRAM KEY NO. 54

. . . Month's Talk from Page 52

to buy the ones they replace. Even though the newer equipment is much more efficient than the old, it still costs, on the average, much more per unit of production than the older equipment. Besides the enormous addition to the cost of new facilities created by inflation, the advance in technology carries with it a built-in factor of higher replacement cost that must be taken into account. What this means is that you can't replace an old machine with a new one just by recovering the cost of the old one.

The advances that have been made in the laws and attitudes concerning depreciation allowances are big and important. They will contribute to the economic health of the country. They will help industry to stay somewhere near even with science and engineering in this revolutionary age and provide jobs for the country's workers. But we still have a long way to go before our public policy on this subject is really modern.

In this connection, we might profit from the experience of certain other countries that have used tax incentives to encourage industry to expand and modernize. I understand that among the most interesting of these tax incentives are those that have been employed by Australia, Belgium, England, West Germany, Sweden and Switzerland — and some of them might be adaptable to our own situation.

Right now, tax experts are preparing for another Congressional review of the nation's tax policies. We can hope that as a result of these tax studies and discussions the government will take due notice of the present speed of machines obsolescence and the high cost of replacement in shaping tax policy on depreciation.

In a recent study of this problem, the Machinery and Allied Products Institute concludes that "if business as a whole is to absorb the annual growth in the private labor force, offset the current consumption of its fixed assets, and provide for a normal growth in investment per worker, it must find each year $35-40 billion in long-term capital . . . This is a huge sum by any standard. But it must somehow be found if we are to continue the rate of growth and improvement that has characterized our development in the past."

Realistic tax legislation on depreciation allowances, along with the wise administration of the law, can be a major factor in providing the capital funds to fuel the nation's progress. And to a great extent it can make that progress independent of temporary tight conditions in the money market.

No one knows better than you who are associated with the petroleum in-

. . . Continued on Page 57

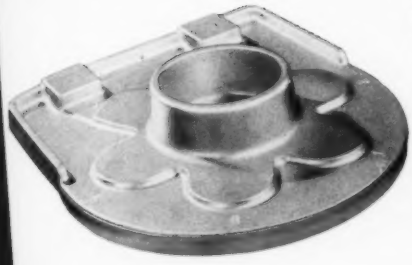
main valve seat for fire plug

Sand-cast pegs bent easily, causing improper fire plug operation. Full line pressure could not be maintained. Machining often uncovered blow-holes causing rejects. Switched to brass forging for higher strength, dense structure, closer tolerances, reduced over-all costs.

quick-acting fuel coupling

To enhance its reputation for quality and to assure tightness under pressure, Ever-Tite Coupling Company turned to forgings for quick couplings used to transfer petroleum and other liquids. Because of the abuse to which this type of equipment is subjected, forgings offer unexcelled performance.

base for TV signal transmission



Porosity and blow-holes in sand-cast part caused "high standing wave," or loss of power feeding into TV transmitting tower through base on end of cable. This required tearing down whole assembly at considerable cost. Switch to dense, strong forging eliminated rejects and power leakage.

water meter lid and register box

Lid converted from sand casting to brass forging. Register box from sand casting to pressure die casting. Weight reduced greatly on both — thus lowering costs. Closer tolerances after change eliminated costly machining on the box.

Vital Change

from sand castings to brass forgings

Titan brass forgings are more easily drilled, tapped, broached and milled than are sand castings. Fewer machining rejects result. Forgings are hot-pressed quickly, are denser, tougher and stronger. Moreover, brass forgings have a smooth beauty and warmth not obtainable in sand castings. Scrap is reduced. Some machining operations necessary on sand castings are actually eliminated by switching to accurate-dimensioned forgings. Getting down to brass tacks, what this means to you is lower costs and a better product by switching to Titan hot-pressed brass forgings.

Send us a sample, drawing, and production quantities of sand-cast assembly parts you now use. We'll quote you on changing to brass forgings.

If you want more data on Titan brass forgings, send coupon below:

Titan

METAL MANUFACTURING COMPANY

Bellefonte, Pa. Offices and Agencies in Principal Cities

Dept. U-20.

Titan Metal Manufacturing Co., Bellefonte, Pa.

Gentlemen:

- ☐ Will send sand-cast part and details for you to quote as brass forging
- ☐ Please send further data on Titan brass forgings
- ☐ Have Titan representative call

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Company_____

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5" VERTICAL SHAPER

Designed and built to meet the most exacting U.S. precision engineering standards.

The Chomienne Vertical Shaper with 5" stroke is a compact rugged machine, ideal for accurate slotting operation. A must to the well equipped die shop. It is a proven time and work saver on jobs requiring machining of irregular shapes and forms.

Users report it's the most-used machine in their shops. Operators like its ease and simplicity of set-up and operation.

Low in initial price, Chomienne Vertical Shapers will repay their investment through savings in time and fixture costs alone. Parts and fast service are available from all major cities. Write for catalogs—

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DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL . . . YOUR FULL GUARANTEE OF SATISFACTION

CIRCLE INFORM-A-GRAM KEY NO. 56

... Month's Talk from Page 54

dustry that continued progress for the rest of this century is going to be far from a downhill coast for this or any other country. On every hand you can see increasing pressures of population and higher rates of consumption on resources in all parts of the world. There is no point in turning away from this fundamental truth about the times we live in. *It is going to take all of the scientific and technological progress that can be generated to enable mankind to maintain or increase living standards in the face of declining resources.*

What I have been saying today is that industry has a very important part to play in this great effort — and that it needs the support of the whole national community it serves to play that part well.

Right now the people of this country appear to be in greater agreement on economic aims and objectives than at any time in many years. This agreement arises, in my opinion, from a general feeling that we are on the right track to a very bright tomorrow. The dedication to the future, which is so characteristic of our time, is a major force for continued progress.

In this spirit we can count on the nation's great problems being tackled in a rational and constructive way. *We can look forward to many years of dynamic cooperation of all groups in our American society toward the full realization of the promise inherent in our great heritage of freedom.*

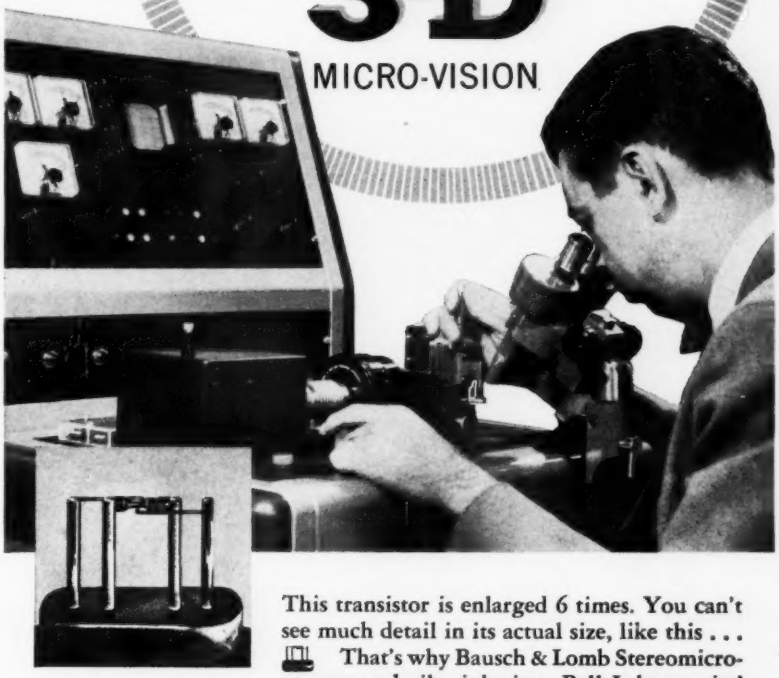
Presteel Closes Steel Rolling Activities

Increased demand for metal stampings has brought the "end of an era" at Worcester Pressed Steel Co. of Worcester, Mass. The company's president, Carter C. Higgins, announced recently that it would give up its 47-year-old steel rolling activities in order to make way for increased stamping business.

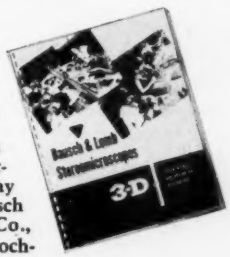
All the company's rolling equipment has been sold to the Rome Strip Steel Co. of Rome, N. Y. New blanking presses are to be installed in the building that housed the steel rolling equipment machinery.

The rolling activity was initially undertaken so that Presteel could secure better material for its stamping presses than was available elsewhere at that time. Its Belgian three-high mill was installed in 1912.

How BELL TELEPHONE LABORATORIES assure precision in sub-miniature assemblies with 3-D MICRO-VISION



This transistor is enlarged 6 times. You can't see much detail in its actual size, like this . . . That's why Bausch & Lomb Stereomicroscopes are built right into Bell Laboratories' ingenious experimental machine, "Mr. Meticulous," which automatically assembles hair-thin elements in steps involving movements of 1/20,000 of an inch! Without visual fatigue, technicians get vividly magnified views of these tiny parts and intricate operations. We're mighty proud of the part B&L Stereomicroscopes play in helping Bell Laboratories achieve miracles in electronic technology to improve telephone service.



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See actual stereo views! Choose exact model from industry's most complete line, with unique Selector-Chart! Write today for manual D-15. Bausch & Lomb Optical Co., 77312 St. Paul St., Rochester 2, New York.

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STEREOMICROSCOPES

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PUBLICATION PREVIEWS 118
Capsule description of current literature. Bulletins, brochures, catalogues and circulars — You name it.

SHOP AIDS 149
Need help in any aspect of modern metalworking? See this section for materials and design aids, inspection and production techniques.

PROGRESS ON PARADE 150
Check this carefully. It can bring new efficiency to your operation. The newest in machines, tools, and accessories.

Speed FORMING and FABRICATING
New 36 page catalog . . . packed with time saving "Die-Less Duplicating" techniques
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PRECISION METALWORKING MACHINES
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Benders 5 Models
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Press Brake 1 Model
Hydra Power Bender 2 Models
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Notcher 1 Model
Power Notcher 1 Model
Power Press Brake 1 Model
Shears 4 Models
Punch Press 2 Models
Power Punch 2 Models
Rollers 8 Models
Brakes 10 Models
Powershear 4 Models

CIRCLE INFORM-A-GRAM KEY NO. 58

EDITORIAL: Ingenious Tooling — No Monopoly 61

— FEATURES —

TALK OF THE MONTH: "The Dynamics of Confidence" by L. L. Colbert, Chrysler Corporation 6

Confidence of industry in the future of America is exemplified by Mr. Colbert in his discussion of industry's progress through research, product development, and willingness to foster plant expansions.

TUBULAR STAMPINGS: "How You Can Save With Tubular Stampings" by Julius F. Hullman, Will-O-Hill Industries, Inc. 62

Tubing lends itself to a multitude of well known fabricating techniques, however, it is much less conventional to find a piece of tubing used as the blank for subsequent punch press operations. The author demonstrates this technique by a number of case histories.

GAGE CARE: "Do's and Don'ts to Make Gages Last Longer" by Peter J. Sommer, Size Control Company ... 67

Heat, dirt, and abuse, the three enemies of gages, can be combatted by proper storage, cleaning, and proper use. Mr. Sommer presents some do's and don'ts, which observed, will make gages last longer.

BROACHING: "Precision Broaching Triples Thread Chasing Tool Production" 70

A broaching job, formerly performed on an arbor press, has been tripled in production since being switched to Multipress broaching.

WELDING: "Automatic Welding Speeds New Chevrolet Frames" by Herbert Chase, M.E. 71

Method of automatically welding together the two steel tubular side rails of the Chevrolet chassis frame at the front portion is described by Mr. Chase.

THROW-AWAY TOOLS: "Big Jump in Use of Throw-Away Tooling Revealed by Recent Survey" 74

Chief reasons for the increased use of carbide throw-away tools appear to be the several indirect cost reductions which this tooling makes.

Editorial Index

UNDER-DRIVE PRESSES: "For Highest Production of Stampings—Design Your Plant Around the Presses" by A. Clements, Baldwin-Lima-Hamilton Corp. 75

Development activity in the heavy stamping field has in recent years been concentrated on mechanical presses of the under-drive type. A plant built to accommodate these presses has a decided production advantage.

PLASTIC DIES: "Plastic Facing Lowers Costs of Drop-Hammer Dies" by Dwight Peerman and W. L. Minarik, General Mills, Inc. 77

One of the latest successful applications in tooling is the use of plastics for drop-hammer dies. The authors present the procedures followed in developing a drop-hammer die faced with a Versamid-epoxy plastic combination.

INVENTORY MANAGEMENT: "The Principles of Inventory Management that Lead to Higher Profits" by Nyles V. Reinfeld, National Institute of Management, Inc., Part II of three parts. 81

The preceding section of this series discussed the problem of how much to order at a time. This part considers the problem of when to order, or at what stock level.

CONTROLS: "Servo and Feedback Principles Explained" by Fred L. Kahl, General Electric Company 85

The terms servo and feedback are explained in a simple manner by comparing certain movements of the human body as actuated by a servo and feedback system.

FOREMEN: "How Many Men?" by Dr. Erwin K. Taylor, Industrial Psychologist 102

If you suspect that some of your foremen are overloaded or underloaded, the suggestions made by Dr. Taylor may be helpful.

DIE DESIGN: "Punch and Die Design for Laminated Plastics" by E. C. Graesser, National Vulcanized Fibre Company 142

Basic factors to be considered in the design of dies for punching laminated plastics are presented by Mr. Graesser. He demonstrates the use of dimensional correction factors by means of a specific example.

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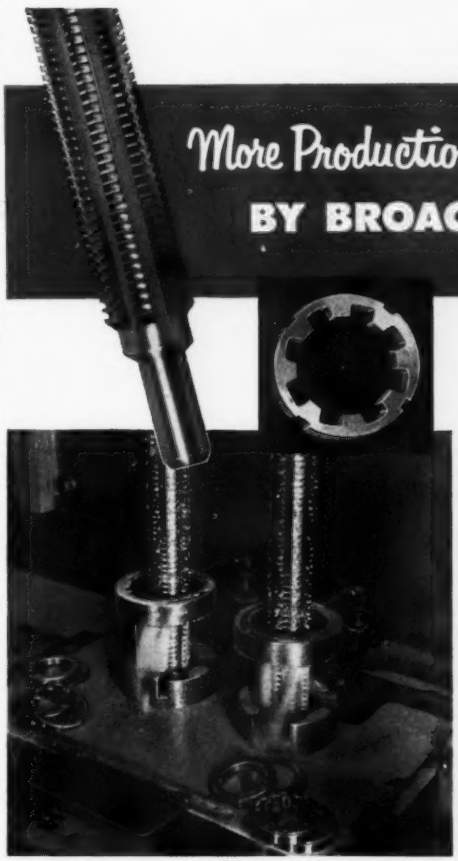
More Production, More Profit
BY BROACHING . . .



Internal broaching of a cam ring. Note the complexity of the ring design. The steel is soft and tends to tear, yet this Continental Broach sizes the I.D and cuts 8 splines 5/16" deep in one pass.

REMOVE STOCK TO PRECISION LIMITS—FAST . . . ROUGH AND FINISH IN ONE PASS!

The scope of Broaching has broadened in recent years. Many broaching operations do precision work in far less time than other metal-cutting methods.

Continental Engineers have for years been designing all types of cutting tools and broaches. They can recommend without bias your most economical way to do the work.

For facts about increasing your production by broaching, call in your local Ex-Cell-O representative—or write Continental in Detroit for Cutting Tool Catalog.

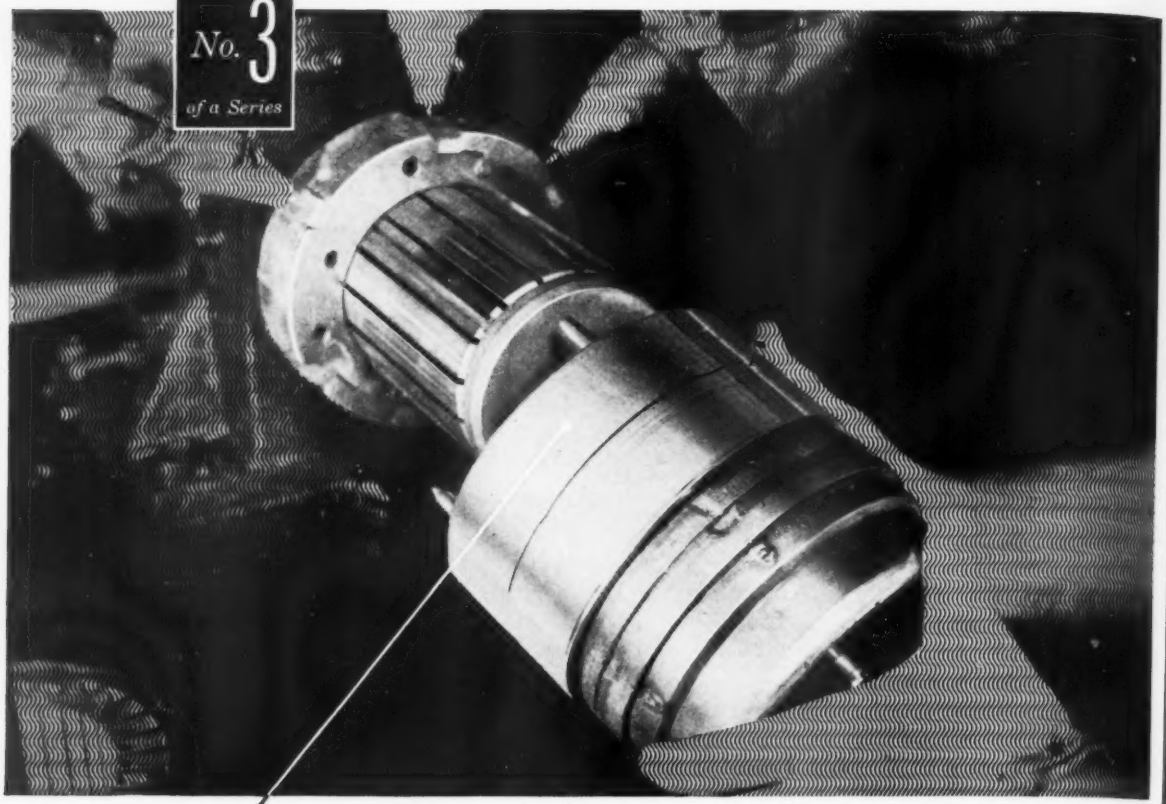
CTW

Continental TOOL WORKS DIVISION OF EX-CELL-O CORPORATION DETROIT 32, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 59

Erickson Precision Expanding Mandrels Solve Assembly Problems

No. 3 of a Series



Photos: Courtesy The Emerson Electric Mfg. Co., St. Louis

e.g. electric motor stators

Emerson Electric, big-name electrical manufacturer, assembles stator laminations the modern way—with Erickson Mandrels. Gone are the old-fashioned arbor assembly methods that require a large tolerance between laminations and arbor . . . that lead to eccentricity of stator bore and to additional finishing operations on the OD.

Emerson Electric works "from the inside out" with Erickson Precision Expanding Mandrels. Laminations are placed on a fixture and the fixture slipped over the expanding mandrel. Laminations are then welded together with two passes through a three-torch head.

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If this cost-cutting case history triggers your imagination, contact the nearest Erickson representative. He'll be pleased to demonstrate how Erickson Precision Expanding Mandrels can cut your assembly costs.

AA-4133

Collet Chucks
Floating Holders
Tap Chucks
Indexers

ERICKSON TOOL COMPANY

2301-12 Hamilton Avenue • Cleveland 14, Ohio

Tap Holders
Air-Operated Chucks
Expanding Collets
Special Holding Fixtures

ID of stator assembly (lower left) requires no finishing operation after welding.

Bothered by a tough holding problem? Then let us show you how Erickson mandrels speed production, lower grinding or inspection costs. Write for Catalog K.

CIRCLE INFORM-A-GRAM KEY NO. 60

editorial:

Ingenious Tooling - - No Monopoly

INGENIOUS TOOLING is by no means a prerogative of multi-million dollar plants. Sometimes, as we stand in rapt admiration of a block-long transfer machine performing a multitude of successive operations we are a little prone to forget that its very magnitude precludes some of the touches of sheer ingenuity that are evident in more modest tooling accomplishments.

This is because of the great number of engineering minds that have been enlisted in the creation of the monster. In such regimentation of tooling talent there is bound to be a leveling-off of inspirational thinking in interest of the common cause. As in most other group efforts there is no room for prima donnas.

If the transfer machine is one that performs a great number of drilling operations, it breaks down into a number of individual drilling stations, each acting as a conventional and well-behaved multiple-spindle drill press — operating at an angle or even over on its side, but still a drill press.

The thinking that went into it was drill press thinking. Add transfer mechanism thinking, an aggregate of engineering knowledge of tracks, slides, cylinders and clamps, and we have automation. No one element is revolutionary, it is the wonderful built-in coordination, accuracy, and repetitive capability and reliability of the over-all assembly that makes automation the art that it is; it draws on the tried and proved practices of generations of metal-working.

Now that we've made quite a case for the wonders of automation, are we "out on a limb" as regards our opening statement that "ingenious tooling is by no means a prerogative of million-dollar plants"? Not at all.

A few days ago we were in a small plant — a very small one — where a high production run was being made of reducing the OD at the midpoint of a short length of tubing. Considering the number of conventional ways this could have been done, who but a genius would think of doing it on a shaper? He did, he was, and at a competition-beating cost advantage.

Here's another case we saw of a shaper being used for a purpose never dreamed of by its maker; another case of the tooling ingenuity of a lone individual, the proprietor of an eight-man tool shop. He manufactured a line of two-fluted counterbores with solid pilots. The surfaces of the pilots had to be unmarred by any cutter gashes caused by over-run of a milling cutter in milling the flutes — the conventional way of doing the job.

This tooling genius rigged up a shaper with centers on its table under and parallel to the ram travel. The counterbore blank was mounted between the centers which were arranged to rotate the work a few degrees with each stroke of the ram. Thus the shaper tool, conventionally mounted on the clapper box, generated the spiral flute — the spiral resulting from the straight-line travel of the tool in combination with the rotation of the work-piece. The shaper tool stopped in the relief behind the pilot — hence no gashes. The setup was both automatic and ingenious.

As you read this month's feature article, "How You Can Save With Tubular Stampings", you will see a great deal of evidence of ingenious tooling. Of course, the very idea of making the parts from tubular blanks is, in itself, ingenious. The cam-operated, opposed-sled dies with the interposed vertical work transfer wheel show original and ingenious thinking of a high order.

The ability to come up with ingenious tooling stems from the inventive or creative type of mind. Some men have it and some don't — some have it as a latent gift and don't know it. It has to be fortified by a thorough knowledge of machines, tools, and the behavior of metals. This knowledge combined with imaginative and creative thinking is what enables one man to envision a shaper for generating a spiral cut, while to another man a shaper is just a shaper.

Ingenious tooling is sparked by the needs to meet competition — by economics — and by make-do. It may mean getting a job on a time and delivery basis that couldn't otherwise be met. It may mean effecting production cost reductions in a job otherwise prohibitive. And many times it means the only way of running a job on the equipment at hand.

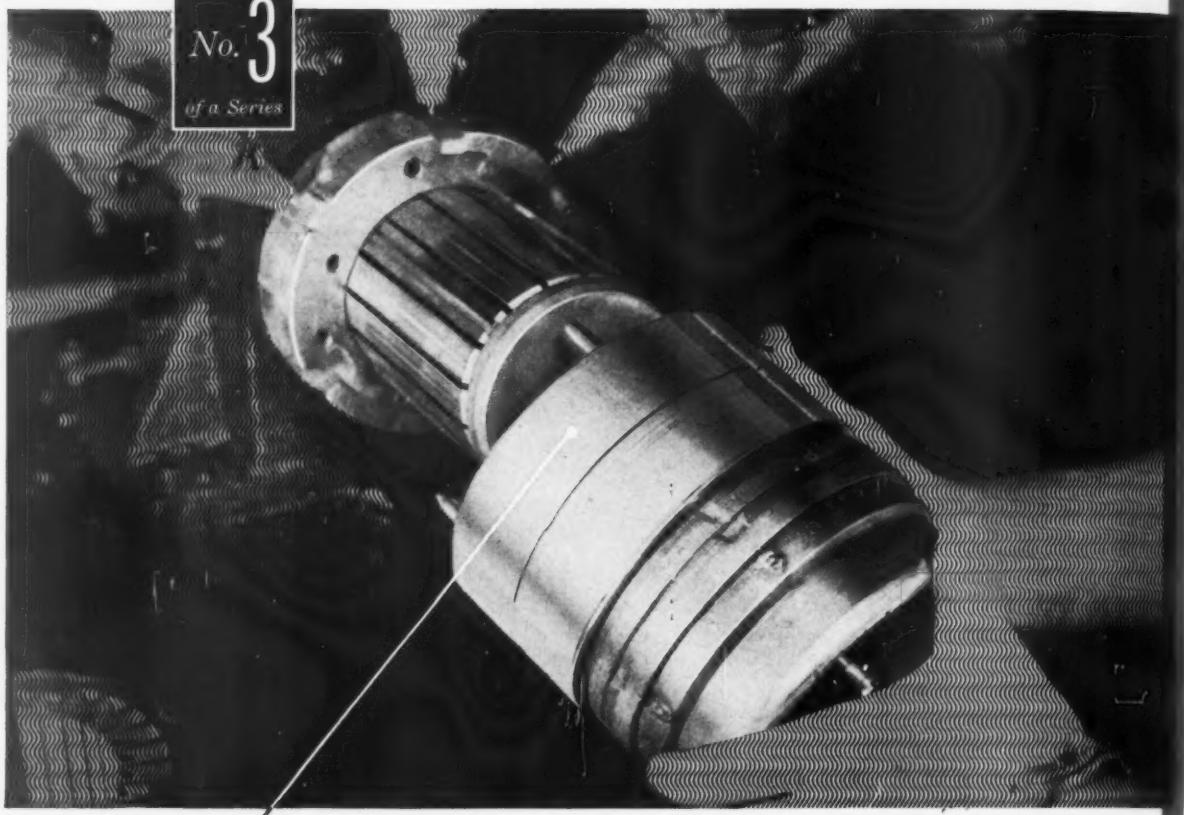
Ingenious tooling is not the private preserve of "bigness". It represents the inspired capabilities and attainments of the individual, wherever and however he may be situated, the man who can "throw the book away" and dream up a new approach. The incentives for creating ingenious tooling are many and great — and so are the rewards.

E. Willard Pennington

editor

Erickson Precision Expanding Mandrels Solve Assembly Problems

No. 3 of a Series



Photos: Courtesy The Emerson Electric Mfg. Co., St. Lou

e.g. electric motor stators

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How You Can Save with TUBULAR STAMPINGS

by Julius F. Hullman
Design Engineer
WILL-O-HILL INDUSTRIES, INC.
Willoughby, Ohio

THERE ARE COUNTLESS PRODUCTS made out of metal tubing. The inherent characteristics of tubing are taken advantage of for the design and manufacture of many products, ranging from heat transfer devices to garden furniture. Also, tubing lends itself to a multitude of well known and long-established fabricating techniques such as bending, brazing, crimping, flaring, and threading, to name but a few.

Far less conventional, however, is it to find a piece of tubing used as the blank for subsequent punch press operations. That this can be a rewarding approach to many design and production problems is evidenced by the pioneering work done by Otto V. Puzik and Edmund Franke, the founders of Will-O-Hill Industries, Inc., of Willoughby, Ohio.

They have demonstrated that engineering ingenuity combined with a thorough knowledge of metal forming procedures can be applied to a suitable tubular blank with an end result that completely eliminates any machining-to-shape operations.

In many cases, the savings achieved in material and production costs were in excess of 50%. Further, users found that the cost of redesigning and retooling a job was only a fraction of the savings attained in only a few months of production.

As far as materials are concerned we so far have been successful in working steel, aluminum, brass and monel.

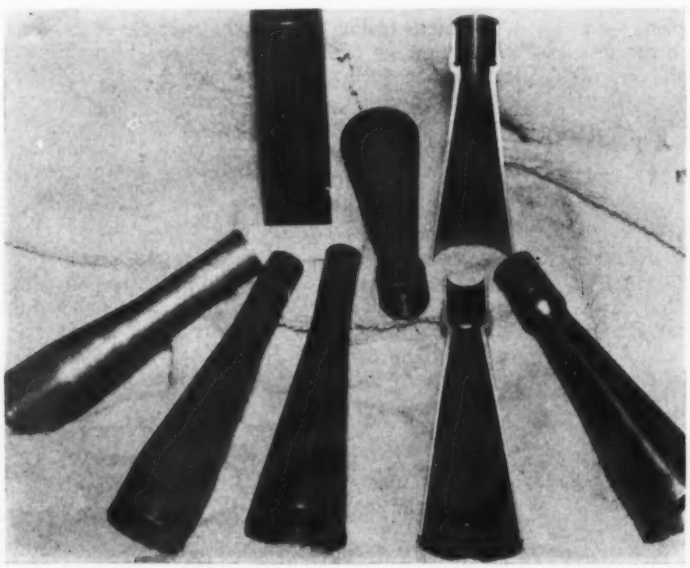

Fig. 1. When this 20-mm machine gun flash-hider was machined from 3" solid bar stock, it was a case of doing it the hard way. Successfully converted to press production from lengths of steel tubing, the flash-hiders were made faster, cheaper, and with no scrap loss in the forming operations.

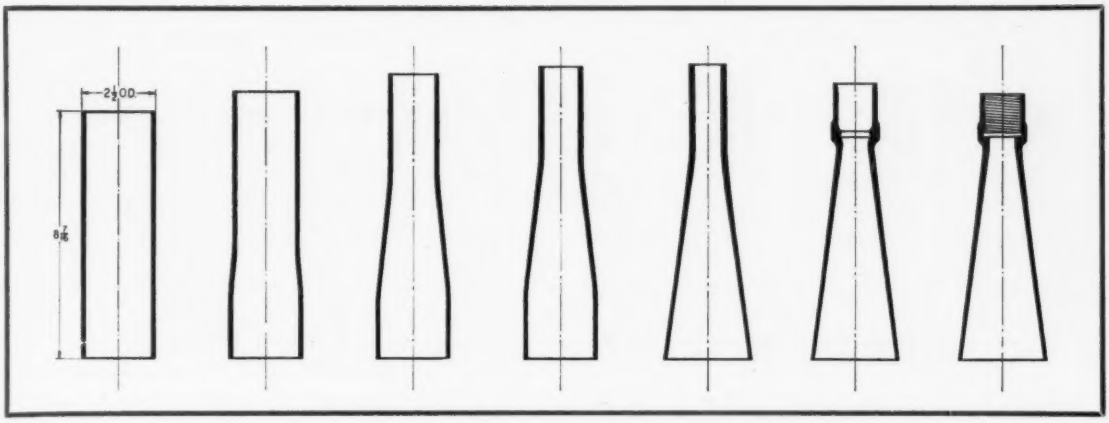

Fig. 2. Starting with 8-7/16" lengths of 2-1/2" OD steel tubing, these successive deformations were accomplished in a press with external dies only. The material removed in threading the hex end was the extent of the scrap.

It is extremely difficult to come up with any rules and regulations covering the designing of a part to be produced from a tubular blank. There is nothing about this new method which you can get from the handbooks. Recognition as to whether or not a part can be produced comes from experience — experience with successes and failures.

Knowledge of how much a tubular shape, of given proportions, can be forced to change, and of how many steps are necessary to effect the change has to be attained by painstaking experimentation before a pattern of procedure evolves. Conversely, this same knowledge must be "on tap" when exploring the possibility of making a tubular product by press working. Accurate determination of tubular blank length, diameter, and wall thickness must be made so that there will be enough metal to go where it is needed and in the shape it is needed, no more, no less. And for each step of the process, the press tooling has to be envisioned which will force the metal to so behave.

Compared with working from strip or sheet stock, there is no excess metal to draw on, with scrap left over. For example, with the exception of any slugs from perforations or chips from a threading operation, a 22-oz tubular blank becomes a 22-oz product. We start out with the calculated tubular blank as all the material available with which to accomplish the end result. This means an irreducible minimum of scrap.

In general we can say that when it would take an expensive multi-station progressive die to produce the initial tubular section of a workpiece, it is cheaper to start with an already-tubular blank.

All of these considerations relative to press working from tubular blanks are best illustrated by several of the jobs which have been run.

Flash Hider

Figure 1 shows the development of a flash hider for 20-mm machine guns, a job for the Army Ordnance Corps. Formerly machined from solid 3" bar stock, production rates were low and there was more machined scrap than product.

Starting with the piece of 2½" OD tubing 8-7/16" in length, shown in Figure 2, the piece was subjected to the succession of press operations shown in Figures 1 and 2. All of these major deformations were done cold with the exception of the hexing operation which was hot forged.

Fig. 3. When this fire extinguisher nozzle was produced by deep drawing from sheet stock, there was a thinning of the wall section at the critical point where the threaded fitting is brazed. This weakness inspired the development of the product from a tubular blank.

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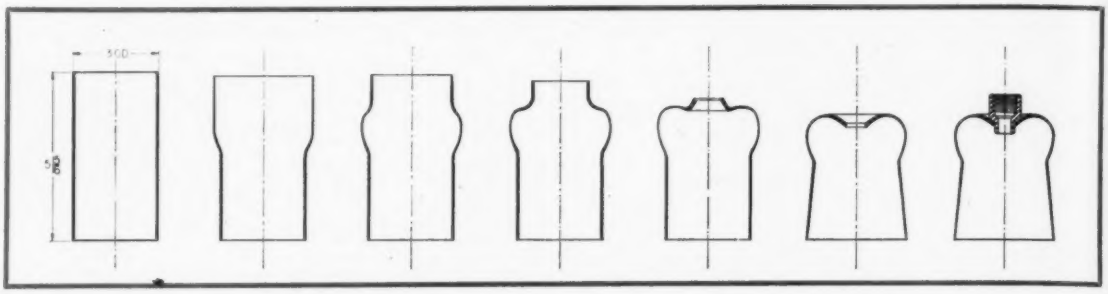

Fig. 4. These forming stages show how Will-O-Hill's method of forming and wrapping so increased the wall thickness as to give adequate supporting metal around the braze. This completely eliminated vibration failures in service.

With a great increase in production rate, with less-skilled help, and on low-hourly-cost punch presses, the savings were approximately 90% over the previous method of machining from the solid.

Fire Extinguisher Nozzle

Figures 3 and 4 show the spray nozzle of a CO_2 fire extinguisher for army tanks. The original production of the product was by deep drawing from a flat blank. The object of the conversion to a tubular blank was to gain metal with which to thicken the wall section (which had been thinned and weakened by deep drawing) where the threaded fitting is brazed to the nozzle. The thickened wall successfully eliminated service failures at this critical point due to vibration of the tank in operation.

The nozzle starts out as a piece of 15-ga steel tubing, 3″ OD x 6″ long. In the succession of operations depicted in Figure 4, the nozzle end is expanded to 3½″ OD and the other end is expanded and wrapped in, whereby the thickened wall is gained.

The forming and wrapping steps were performed with external dies and without using rubber. This part, which in quality and performance fully met Ordnance's specifications, was produced at a considerable saving over the previous method of manufacture.

Ball-Ended Adjusting Nut

The part shown in Figure 5-A required a deep length of thread for adjustment purposes and a hardened ball-end. Figures 5-B and 5-C were two of our alternate suggestions to replace the original design in order to reduce the high percentage of scrap due to the threaded length of the blind hole.

By resorting to a tubular blank instead of solid stock, Figure 5-B offered approximately a 35% saving over the original design. For the ball-end it has a stamped cap crimped over the flared end of the tubing. The ID of the tubular body is reduced to the minor diameter of the thread and is tapped before the ball cap is crimped in place. This design makes both the hardening and the plating easier.

Figure 5-C shows a solid ball-end cap at one end of the tubular spacer and a solid nut at the other end to serve the same function as the original design. It offers a sturdier cap and a wider hex but effected a saving of only 20% over the original.

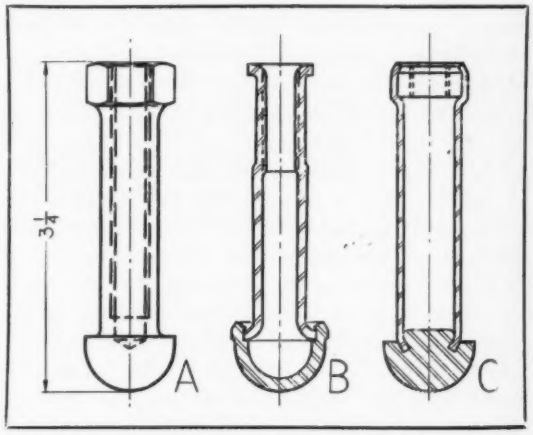

Fig. 5. At B and C are shown alternate redesigns of the deep-threaded adjusting nut A, permitting production from tubular blanks instead of solid stock. At B the reduced ID of the tubing is threaded before the hardened ball-end is crimped on. It represents a 35% saving in cost over the original design, A. The design at C offers a sturdier cap and a wider hex, but at a saving of only 20%.

Shock Absorber Support

The automotive part shown in Figure 6 is an inner tube for a shock absorber support. This was initially made from a malleable casting. The purpose in producing this piece from a tubular blank was cost reduction, with no sacrifice of quality. That objective was attained, and millions of this part have been made.

The production of the part, from a piece of tubing 1″ OD x 3¼″ long and ⅛″ wall, to its finished form is shown in Figure 7. The essence of the development was to produce the part by successive and simultaneous reductions of both ends of a piece of round tubing in such

a way that the roundness of the central portion is maintained within a close tolerance and, further, so that the major dimension (width) across the finally flattened ends of the piece was less than the tubing OD.

This was accomplished by seven reducing operations, one flattening, one piercing, and one trimming operation. Our press tooling for the job incorporated the 10 operations, enumerated in Figure 7, in two dies.

The first die is a two-sled, cam-operated die with a vertical transfer dial between the two opposing die sleds. On the sleds are mounted, circularly in accordance with the stations in the transfer dial, the opposing pairs of reducing die buttons. Figure 8 shows two front views of the die assembly, one from the right

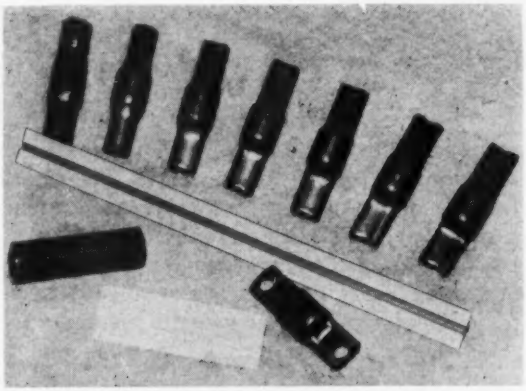

Fig. 6. From the tubular blank in the left foreground, the finished part, an inner tube for automotive shock absorber supports was produced by 10 operations in two dies. The previous design involved a malleable casting.

of center and the other from left of center. The vertical transfer dial or wheel rotates within the central structural member and carries the workpieces from one station of opposed die buttons to the next. The central structural member also carries the lubricant distribution piping to the several stations. We should mention that this method of lubricating the workpiece at each station, as well as the quality of the lubricant is of utmost importance to long die life. The lubricant is continuously filtered and recirculated.

The schematic of Figure 9 shows the relationship of the punch holder, cam, right hand die sled, and stationary retainer to the vertical transfer wheel carrying the workpieces from station to station. The same members to the left of the transfer wheel (not shown) are identical but symmetrically opposed.

With each down-stroke of the press ram, the right and left sleds are cammed toward the transfer wheel. This carries each opposed pair of die buttons over both ends of one workpiece for the degree of reduction performed at that station. When the sleds retract, on the upstroke, the stationary retainers or shedders prevent the workpieces from following, to the right or to the left, the receding die buttons. After each press stroke the transfer wheel is manually advanced one station by the operator.

The operator loads the transfer wheel at the station shown in the near foreground of Figure 8. Then follows the seven indexes and press strokes for the seven reductions. The eighth index automatically knocks the workpiece out of the transfer wheel. Once the transfer wheel is fully loaded, or once around, a finished piece comes off with each stroke of the press.

Referring again to Figure 7, operations 8, 9, and 10 are performed in the second die, the general arrangement of which is shown in Figure 10. It, also, is a transfer die, but with a

Fig. 7. In a press tooled with cam-operated, opposed-sled dies having a vertical work transfer wheel between them, the 3¼" x 1" OD tubular blank is subjected to the above 7 reducing and forming operations. In a second press, equipped with a horizontal rotary index table, are the dies for flattening (8), hole piercing (9) and final trim (10). Each operation is performed simultaneously on both ends of the piece.

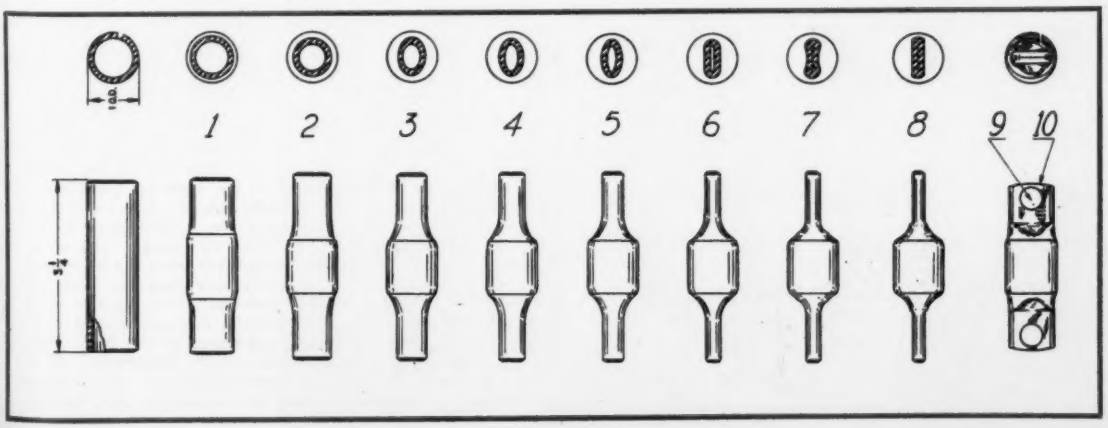

Fig. 8. Two views, front right center and front left center, of the opposed sets of die buttons on either side of the vertical work transfer wheel which rotates within the center structural member. The dies are shown retracted (by the cam action), and in the loaded stations can be seen the tubular workpieces in several stages of reduction. In the foreground of the lower view is the loading station. The transfer wheel is manually loaded and indexed by the operator between press strokes.

horizontal rotary work transfer, and instead of manual operation the indexing is automatic.

In this die are performed the flattening (8), hole piercing (9), and end trimming (10), Figure 7. Each of the operations is performed on both ends of the piece simultaneously. The die is

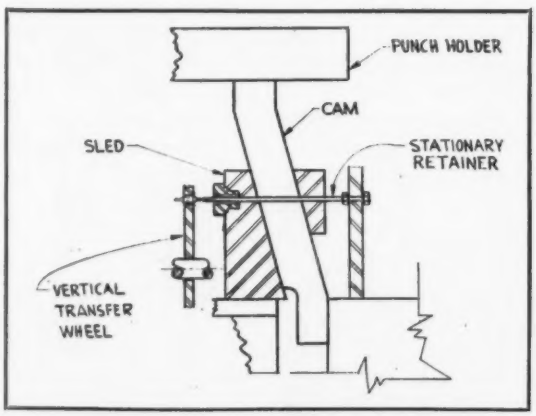

Fig. 9. A schematic of the elements of the press tooling which are located to the right of the vertical transfer wheel. The elements on the left are identical but in symmetrical opposition. Each down-stroke of the press forces (by the cam action) the sled-mounted dies over the workpieces from the right and from the left, simultaneously, and they are retracted by the camming of the upstroke. The opposite pairs of stationary retainers restrain the workpieces from shifting with the in and out travel of the dies—they act as strippers or shedders in both directions. As is evidenced by the "copper plumbing," a generous flood of filtered lubricant is essential at each station.

Fig. 10. The tooling on this press performs operations 8, 9 and 10 of Figure 7. The horizontal index table carries the workpieces under the flattening, piercing and trimming punches in that order. The work is manually loaded, but automatically indexed by the air cylinder in the foreground. Likewise, the finished part is automatically ejected from the table after the final end trimming.

equipped with vertical-operating strippers and knockouts of conventional nature. The rotary transfer table carries the workpieces under, successively, the flattening punches, the piercing punches, and the end-trimming or shaving punches. These punches are arranged on the punch holder over the lower die members for the respective operations. The work dial is manually loaded, and the pieces are automatically ejected from their carrier after the final trim.

In summation, tubular work blanks have endless possibilities. Tubing can successfully be expanded and reduced to almost twice the normal recommendations. We are finding it possible to hold the OD of parts made from 7/16″ tubing to ±0.0005″.

It was not the purpose of this article to show shortcuts in tool design or die making, but to disclose for the benefit of industry what Will-O-Hill has been able to accomplish in producing tubular components. We sincerely hope that we can encourage many engineers to look for the savings that may derive from using tubular blanks.

end

Do's and Don'ts to Make Gages Last Longer

by Peter J. Sommer
Plant Superintendent
SIZE CONTROL COMPANY
Chicago, Illinois

THE THREE ENEMIES OF GAGES—heat, dirt, and abuse—can be effectively combatted by proper storage, cleaning, and use.

A few simple "do" and "don't" rules, displayed at gage stations in your shop, and conscientiously followed, will save many dollars in gage expense, result in greater accuracy, and decrease scrap losses.

Before going into the proper care of gages, a short discussion of features to look for when buying gages is in order.

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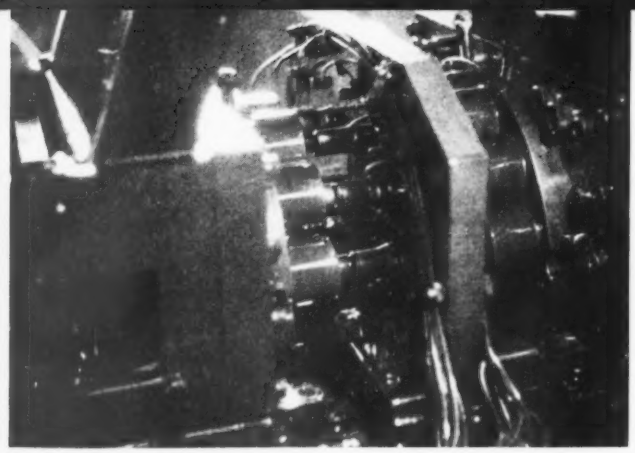

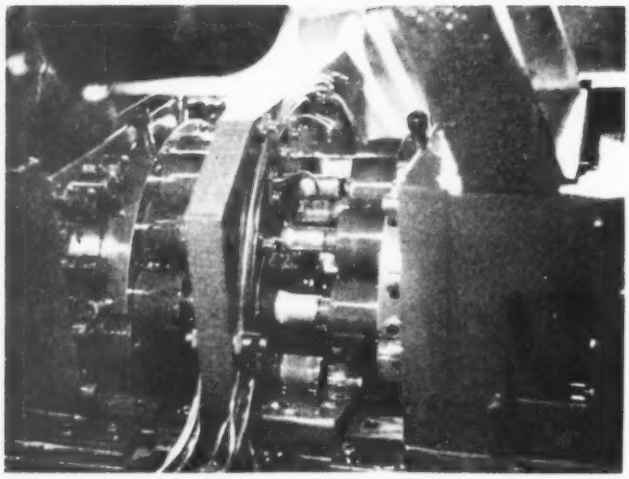

Fig. 8. Two views, front right center and front left center, of the opposed sets of die buttons on either side of the vertical work transfer wheel which rotates within the center structural member. The dies are shown retracted (by the cam action), and in the loaded stations can be seen the tubular workpieces in several stages of reduction. In the foreground of the lower view is the loading station. The transfer wheel is manually loaded and indexed by the operator between press strokes.

horizontal rotary work transfer, and instead of manual operation the indexing is automatic.

In this die are performed the flattening (8), hole piercing (9), and end trimming (10), Figure 7. Each of the operations is performed on both ends of the piece simultaneously. The die is

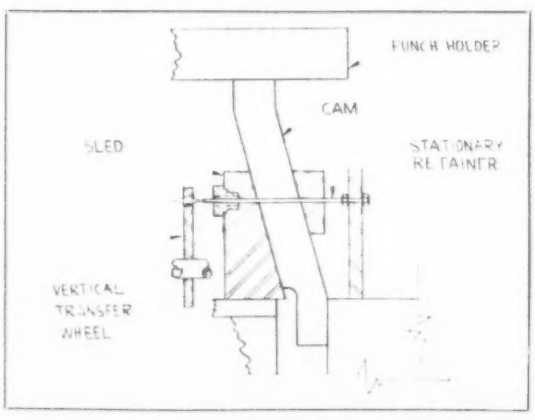

Fig. 9. A schematic of the elements of the press tooling which are located to the right of the vertical transfer wheel. The elements on the left are identical but in symmetrical opposition. Each down-stroke of the press forces (by the cam action) the sled-mounted dies over the workpieces from the right and from the left, simultaneously, and they are retracted by the camming of the upstroke. The opposite pairs of stationary retainers restrain the workpieces from shifting with the in and out travel of the dies—they act as strippers or shedders in both directions. As is evidenced by the "copper plumbing," a generous flood of filtered lubricant is essential at each station.

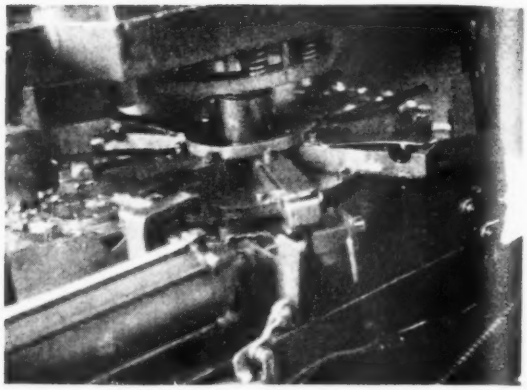

Fig. 10. The tooling on this press performs operations 8, 9 and 10 of Figure 7. The horizontal index table carries the workpieces under the flattening, piercing and trimming punches in that order. The work is manually loaded, but automatically indexed by the air cylinder in the foreground. Likewise, the finished part is automatically ejected from the table after the final end trimming.

equipped with vertical-operating strippers and knockouts of conventional nature. The rotary transfer table carries the workpieces under, successively, the flattening punches, the piercing punches, and the end-trimming or shaving punches. These punches are arranged on the punch holder over the lower die members for the respective operations. The work dial is manually loaded, and the pieces are automatically ejected from their carrier after the final trim.

In summation, tubular work blanks have endless possibilities. Tubing can successfully be expanded and reduced to almost twice the normal recommendations. We are finding it possible to hold the OD of parts made from 7/16" tubing to ±0.0005".

It was not the purpose of this article to show shortcuts in tool design or die making, but to disclose for the benefit of industry what Will-O-Hill has been able to accomplish in producing tubular components. We sincerely hope that we can encourage many engineers to look for the savings that may derive from using tubular blanks.

end

DO'S AND DON'TS TO MAKE GAGES LAST LONGER

by Peter J. Sommer
Plant Superintendent
SIZE CONTROL COMPANY
Chicago, Illinois

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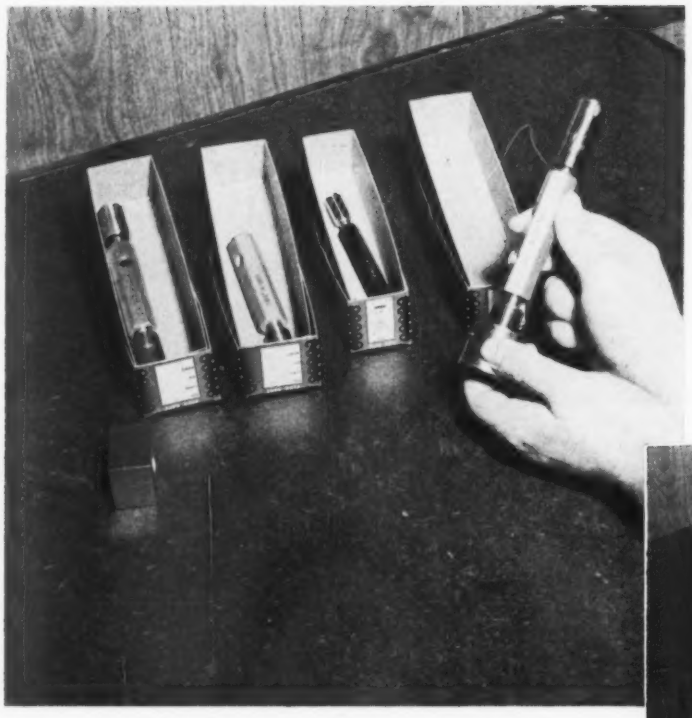


When using a series of gages, those not being immediately handled should be protected by resting in their respective boxes as shown at the left. Gages should never be strewn around on the bench top. The inset illustrates the cardinal sin of gaging: Two gages in contact; a wonderful way to spoil surfaces and nick thread crests.

is the most economical in the case of a long production run or for particularly abrasive materials. For short runs, chrome gages, which are a little more expensive than steel, are most appropriate.

Look for easy identification in reversible gages of GO and NO-GO members. This is usually done by color markings on the handles, a system which was pioneered at Size Control several years ago. The GO end of the handle on our gages is green while the NO-GO is red.

You'll get longer use of plain and thread plug gages when you choose the reversible type, a design pioneered by us and now widely adopted by industry. With this type of gage you can cut off worn reversible end to expose new usable sections, which gives your gages six to eight times more life.

Look for positive locking handles which grip the plug securely, and which can be easily loosened for replacing or reversing a worn member.

Make sure that gage members are straight and round and within tolerance to provide uniform gaging surface over the entire length.

For long life, check to see if the gage you buy is finished to 1.5 micro-inches rms or less.

A gage that's hardened throughout is more economical since it enables a worn gage to be ground down to the next size.

Gages are the key to size control and as such are a necessary part of your production costs. Don't place them in that nebulous, all-inclusive classification of general overhead. Gage costs should be figured as a part of your manufacturing costs.

More Gages Become Un-Usable Due To Abuse Than Use

To care for your fine gages properly:

- Don't force them into or over the part being checked. If the GO member won't fit, forcing may damage the gage or workpiece or both.
- Don't lay gages on metal benches or machines. The gages quickly reach the temperature of the metal. If the metal is warm, the gage will expand and if it is cool, the gage will contract, destroying accuracy in either case.
- Don't lay gages on dirty surfaces of any kind. A dirty gage gives inaccuracte results.
- Don't clean gages in water, soluble solutions, kerosene, or carbon tetrachloride. All of these cause rusting. The best way to keep a gage clean is to wipe it frequently with a clean dry cloth, or special rust-inhibiting oils made especially for this purpose.
- Don't spin parts on or off gages. This too common practice doesn't speed the gaging process nor contribute to accuracy. About all it does is wear out gages needlessly.

• Don't ever throw a gage down, no matter how resilient the surface.

• Don't use a gage for a hammer. Use a hammer.

• Don't lay gages in the sunlight — expansion will cause errors.

• Don't use gages that fit loosely. Learn to know the "feel" of proper gaging.

• Don't use gages that show visible burrs, nicks, or other irregularities. When these show up or other signs of wear appear, it's time to reverse the reversible gages and/or to remove the worn portion by grinding it off.

Rules for Use and Care

On the positive side — here are the Do's:

• Learn to hold and use your gages properly. Fit should be snug and smooth.

• Make wooden, felt covered gage racks for proper storage.

• Oil the felt surface of these racks to help keep the gages clean.

• Roll or twist the gages into the work to get the proper feel.

• Check every gage against its master before using, at least once on every shift, and again before returning it to the tool crib.

• Oil gages before putting them away, and store them in a rust-inhibiting paper bag or special gage box.

Rules are meaningless unless they are followed, and they won't be followed unless they're publicized within your plant. To let your people know about correct gage care and to keep reminding them is a program in itself.

Permanently display Do-Don't rules prominently at each gage station. Size Control will be happy to supply you at no cost to you with cards on which these suggestions are printed.

When you address your employees for any purpose include a few words on good gage care.

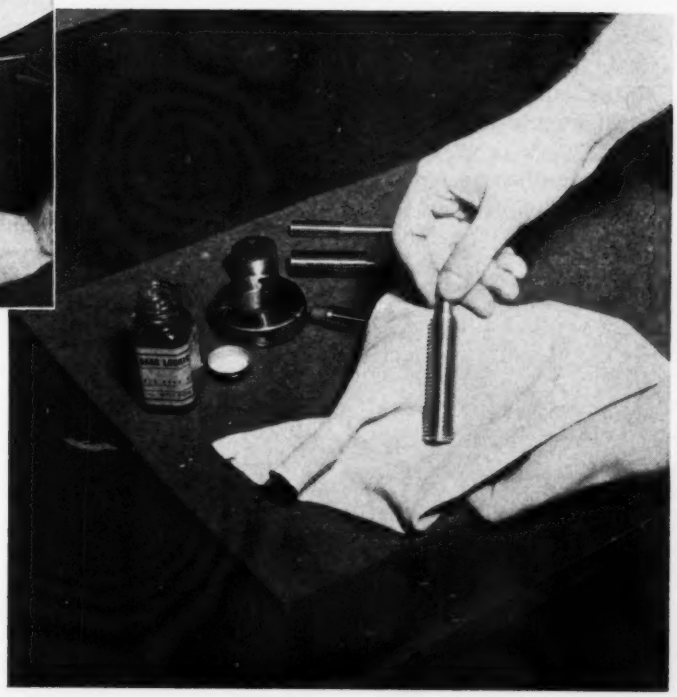
An occasional mention in your employee publication or newsletter on gage maintenance is another help.

Type up one or two gage hints, post them on in-plant bulletin boards, and change them frequently for variety.

Place one or two "horrible examples" of gages and piece parts ruined by misuse where all can see them.

Remember that the key to these simple rules is habit. Make proper gage care, in accordance with this DO and DON'T chart, the personal habit of each operator, and you'll be assured of economical and accurate gaging. **end**

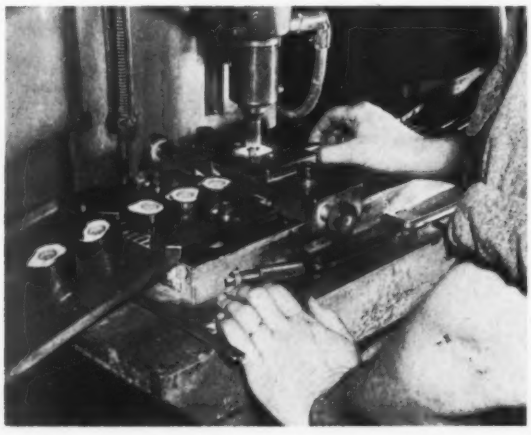
At the right is shown the correct method for cleaning a gage. It should be dipped in a proper gage lubricant and wiped with a clean and dry cloth. Kerosene should never be used on gages because it promotes rust. Remember that a dirty cloth can get the gage no cleaner than the cloth.



Precisioned Broaching Triples Thread Chasing Tool Production

THE NATIONAL ACME COMPANY of Cleveland reports production of circular thread chasing tools has almost tripled, and could, if demands required, be more than tripled, since the installation of several 8-ton hydraulic Multipress units. The units are used for blind broaching internal serrations of thread chasing tools.

Formerly, the job was performed on an arbor press, a method necessitating considerable manual effort to force the broaching tool into the part. Maximum output using this hand insertion method was approximately 100 pcs/hr. Production rate since the installation of the Multipress equipment, manufactured by the Denison Engineering Company, Columbus, has jumped to 272 pcs/hr on each unit. In addition, labor fatigue has been greatly reduced and a major reduction of operating costs realized.



Denison engineers incorporated into each machine a vibratory action, with a micrometer stop for regulating the depth of stroke to serrate only the bushing length of the circular thread chaser. A valve provides automatic cycling of the ram, plus vibratory repeat strokes.

Operation of the press consists of placing a part in the stock-guide channel and sliding it into position against two spring-loaded stops. The part is then ready for processing. This is accomplished by merely depressing the foot pedal which causes the ram to move downward. Upon contacting the work, the three vibratory repeat strokes are administered to the piece. In addition to broaching, the vibratory movement of the ram actually provides a polishing action. This ensures greater uniformity of parts and eliminates buffing at a later stage.

After the cycle is completed, the broached piece is pushed past the two positioning stops and ejected. The stops then snap back into position and locate the next workpiece.

From a safety standpoint, the presses are designed to operate without the use of the operator's hands once the piece is inserted into the work holder. This is also a cost savings factor, in that unskilled workers can operate the machines and insurance costs are reduced.

Maintaining production requires but four hours per day when the press is used. Thus, considerable time is left for operators to assume other duties.

end

Two pairs of machines produce two seams in joining channel stampings that form center sections at kickup of side rails. These are joined subsequently to tubular front and rear sections. Strong welds result.

AUTOMATIC WELDING SPEEDS NEW CHEVROLET FRAMES

by Herbert Chase, M.E.

WHEN CHEVROLET ENGINEERS designed a new type of frame for the chassis of Chevrolet cars, it was decided to make the front and rear sections of each side rail from seam welded steel tubing. These two sections have to be joined by a short center section that forms the forward portion of the rear kickup, as indicated in Figure 1. Frame fabrication is done by the new Chevrolet-Flint Manufacturing Division of General Motors.

Each center section includes two short channel shaped stampings (left in Figure 2), and the edges of the channel legs have to be joined, as at right in Figure 2, to form a short curved tube. Both of these joints, each of which is curved, are produced by automatic arc welding in two duplicate pairs of National machines, each of which includes two of The Lincoln Electric Company's submerged arc heads. Two views showing one of these machines appear in Figures 3 and 4.

In each machine, there are two horns to support the workpieces. A pair of stampings is first fitted and air clamped, so that the chan-

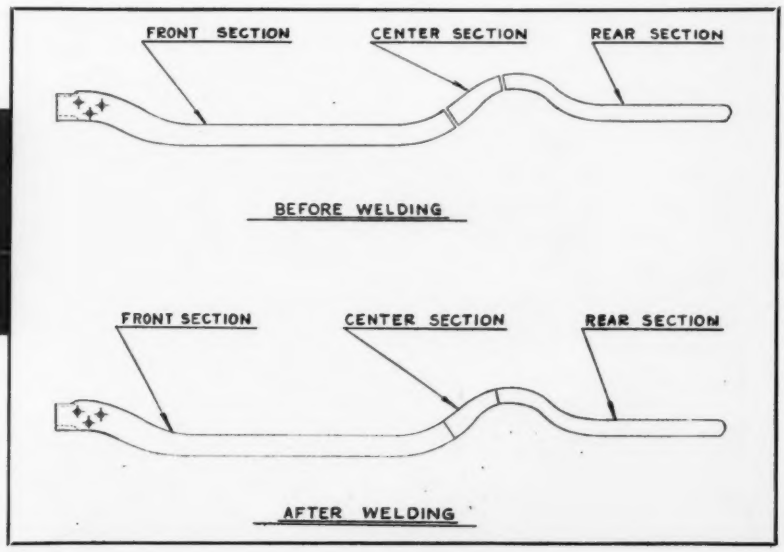


Fig. 1. Showing how the new Chevrolet frame side rail appears in side elevation before and after welding. Text relates chiefly to the automatic arc welding of the center section, connecting the front portion to the rear kickup.

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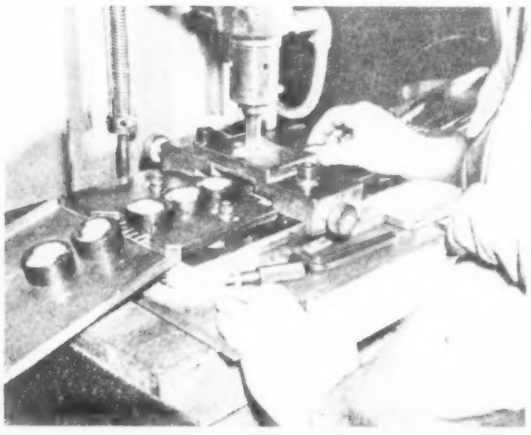

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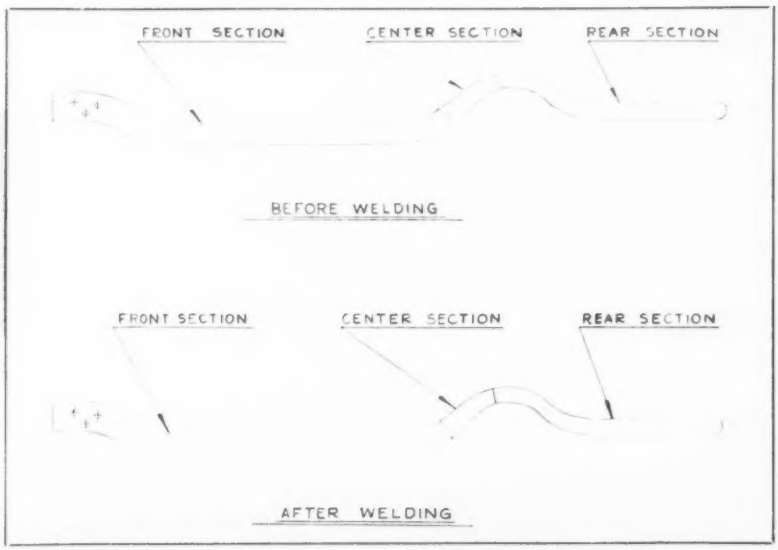

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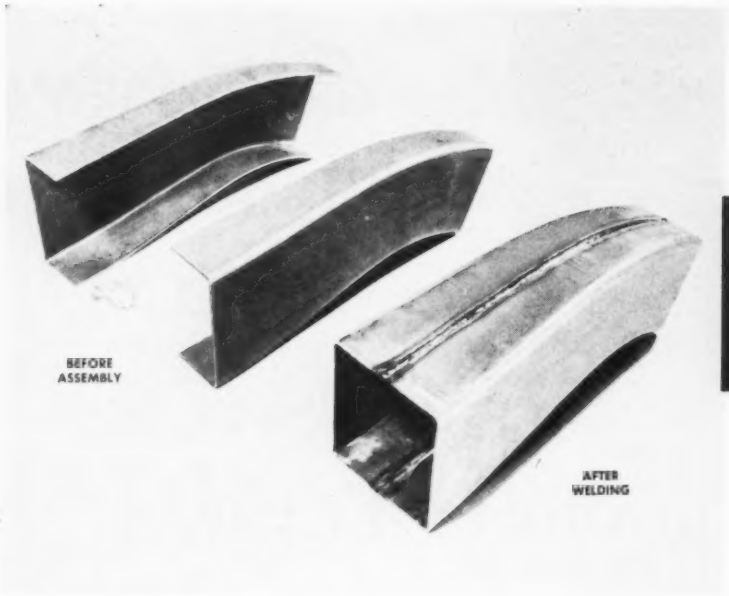

Fig. 2. Center sections are produced from two curved channel shaped stampings (background) that are welded to produce the short curved tube pictured in the foreground.

nel stamping edges are held together on the left horn in Figure 3. There, the first weld is made above a copper backup, the electrode following a convex curve as it is advanced. When this weld is completed from end to end, the piece is unclamped, removed by hand and placed on the right horn. There, with the piece again air clamped, this time below the second head, the electrode follows the concave contour and completes the second weld, leaving the curved tube completed. It is removed by hand.

In both positions, Lincoln L-780 agglomerated flux is fed automatically from a head hopper in advance of the 3/32" electrode wire and keeps the arc completely covered. Flux that does not adhere to the weld falls or is dumped into the tray below both welding positions, is screened automatically, and is then carried upward by an elevator to an elevated hopper from which the flux feeds back to the head hoppers for reuse.

One pair of machines produces a center section for right rails and one for left rails, but each machine makes duplicate welds. As each weld approximates one foot in length and there are two welds per piece, about 600′ of welding per hour is made by the two heads of

Fig. 3. Front view of one of the four machines that convert channel stampings into tubular center sections. After the convex weld is made in the left position, the concave weld is produced over the horn at the right.

each machine. This means that the welding rate exceeds 60" a minute (as no welding is done during the loading and unloading portion of the cycle), hence the welding rate is very fast.

To make each head follow precisely the contour of the workpiece, each head is mounted on a slide that is made to rise and fall by a roller that follows a cam having the precise contour of the workpiece, at the same time that an air plunger advances the head horizontally at a fixed rate. Included in the machine is a device for lowering current input slightly while the electrode is traveling downgrade and for increasing current correspondingly when travel is upgrade. Average current, however, is about 240 amps, supplied at about 25-V potential from 600 amp generators of which there are two per machine.

As soon as each workpiece is loaded over horns and is air clamped, the operator presses a weld control button and the remainder of the cycle proceeds automatically as the weld is made and the head then retracts. Then the workpiece is unclamped, leaving the horn ready for reloading as soon as the weldment is removed.

Heads, of course, are designed to start flux flow before the electrode wires (also fed automatically) strike the arcs and to keep the arcs advancing until the welds are completed. At this point, current is shut off, breaking the arc, retracting the wire and withdrawing the head to initial position, so that the weldment can be unloaded and the next piece can be put in place.

Welds are of high grade and full depth penetration, and the curved tubes produced are well-fitted to resist the heavy stresses imposed in service. Frequent test pieces are checked by being pulled to destruction. In no cases reported have the breaks occurred at the welds, indicating that they are stronger than the metal not involved in the welding. Subsequently, each center section is resistance butt welded to a front and to a rear section.

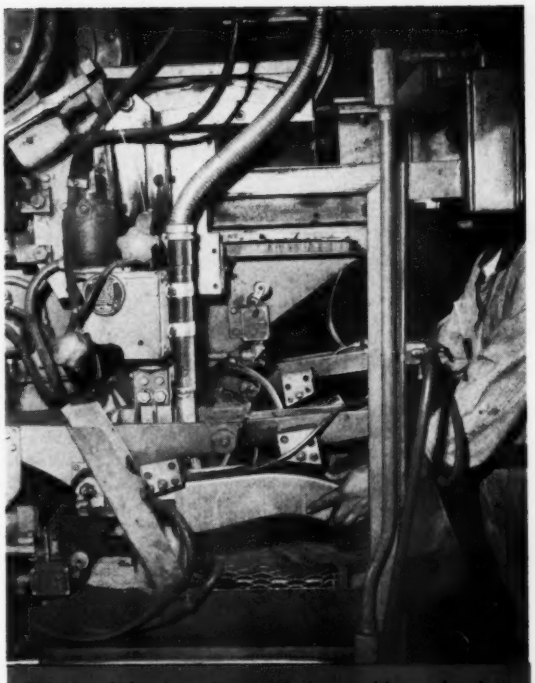

Fig. 4. Side view of one of the machines, showing one of the Lincolnweld heads and, at top center, one of the cams that moves the head support up and down and causes the electrode to follow the weld contour as the head is advanced from left to right by an air plunger.

These welds are the only ones required in fabricating the side rails of the frame. Considerable hand arc welding is done, however, in the fabrication of other frame members and in assembling them to the side rails.

Fabrication by the new method is considered much superior on several scores to the older method and is expected to be less expensive after the development period is completed. The operations here described yield components of high quality. end

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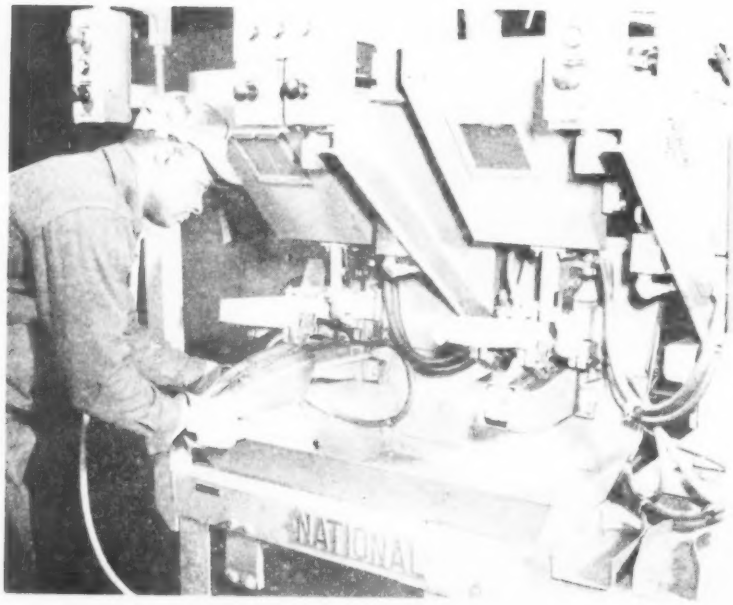

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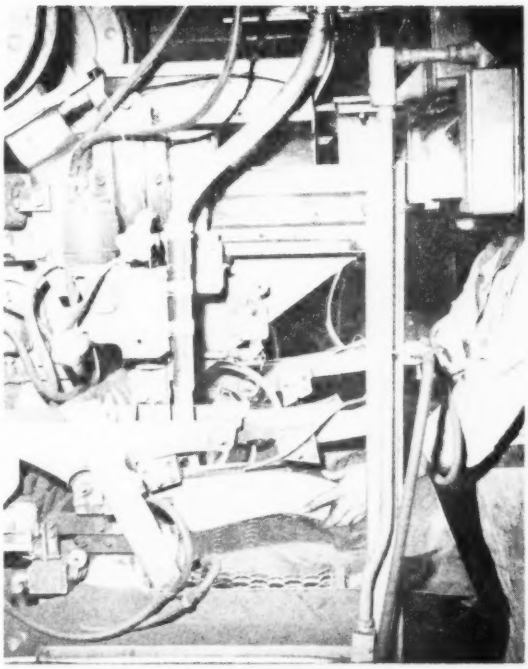

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Big Jump in Use of Throw-Away Tooling Revealed by Recent Survey

INDUSTRY IS LEANING STRONGLY toward the gradual abandonment of cutting tools that have to be sharpened . . . according to a study just completed by an independent technical research organization.

Sponsored by the Wesson Company, Detroit, one of the country's largest producers of carbide tools of all types — and of carbide tool grinders as well — the survey shows that "throw-away" insert tooling will shortly be accounting for the startling total of 40% of all single-point tools used in metalworking. The present figure is 15%.

Even more significant is the fact that the use of "no grind" tools will average 60% of all single point tools in those plants now using or already planning to use these tools. In some companies, current plans call for the use of throw-away tooling in as near as possible to 100% of all operations, the survey shows. Not a single company has reported an intent to use fewer throw-aways than it is now using.

Chief reasons for the trend appear to be the several indirect cost reductions which throw-away tooling makes possible. Maintenance of extensive and costly tool grinding facilities becomes less necessary. Operators skilled in tool grinding are also getting harder and harder to find and costly to train. In addition, the throw-away tools require no elaborate setting up on machines. As a result, machine down-time for tool changes is greatly reduced, thus producing major overall economies — particularly on automated or semi-automated production lines.

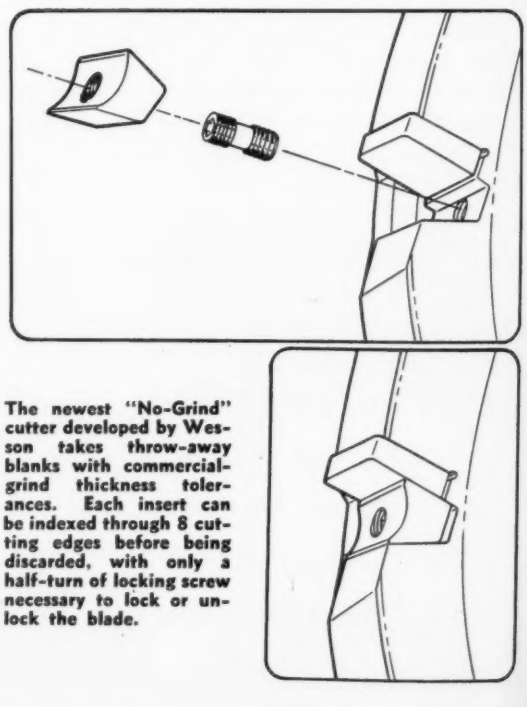
The survey shows that industry is even more interested in the idea of adapting the throw-away principle on a broad scale to milling cutters and other more complex tools, such as boring tools.

A review of the returns shows that this is due to the desire to eliminate grinding — which is even more complex and costly on milling and multi-diameter cutters than on single point tools.

"These developments", says Ray W. Ruckel, Wesson president, "represent the second major change in the history of better tool maintenance. At one time it was customary for every machine operator to sharpen his own tools. The first major step was to relieve the operator of that job and centralize all tool grinding in a tool room in order to assure greater accuracy of tools and higher product quality.

"In throw-away tooling, the responsibility for maintenance of tool accuracy 'on the job' is passed on to the manufacturers of carbide tooling. Since carbide manufacturers — like our own Wesson Metal Corporation — can make the 'throw-away' inserts on a mass production scale, they can effectively use high precision automatic equipment to assure a high degree of accuracy on the inserts despite their low cost."

"This doesn't mean", Ruckel explains, "that plants are going to throw their tool maintenance departments out the window. Where there are well-equipped and well staffed centralized tool maintenance departments, these will continue to be used. What the throw-away tooling does is to eliminate the need for adding to those maintenance facilities or adding hard-to-find tool grinders." end



The newest "No-Grind" cutter developed by Wesson takes throw-away blanks with commercial-grind thickness tolerances. Each insert can be indexed through 8 cutting edges before being discarded, with only a half-turn of locking screw necessary to lock or unlock the blade.

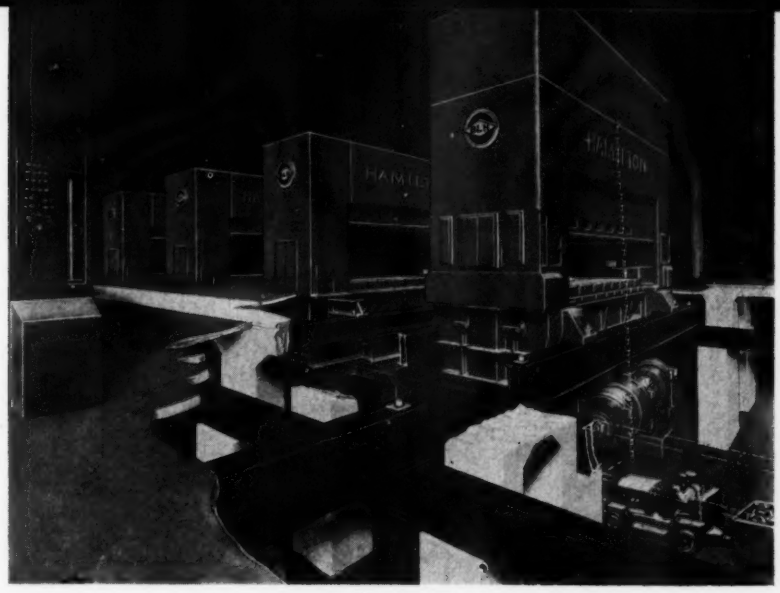


Fig. 1. Typical stamping plant construction, showing method of supporting under-drive presses and main floor on steel beam and concrete pier foundation. A lower level facilitates press maintenance and scrap disposal.

For Highest Production of Stampings

DESIGN YOUR PLANT AROUND THE PRESSES

by A. Clements
Vice President in Charge of Engineering
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MUCH DEVELOPMENT ACTIVITY in the heavy stamping press field has, during the past 10 years, been concentrated on mechanical presses of the under-drive or bottom-drive type. Such presses have been designed in sizes ranging from 400-ton capacity by 84" wide, up to the much larger sizes used primarily by the automotive stamping plants.

Highest stamping production can be obtained with these under-drive presses . . . if the plant is designed around the machines.

With this type of press, much of the electrical equipment, the lubrication center, the gear trains, and other driving members and moving parts are located beneath the production-floor level. Previously, these press members — that require the greatest amount of maintenance — were located in the crown or upper part of the press and the slide was pushed down, whereas in the under-drive press the slides are pulled down.

This means that a lower level or basement of the building must be provided and arranged so as to take full advantage of the under-drive features. Many of the stamping plants built within the last few years were constructed in this manner.

The lower level is about 17' below the production level. The production level is a floor supported by steel beams, which in turn are supported by concrete or steel pillars that extend from the lower level. With press lines set up parallel to each other, these pillars are provided in double rows between the various press lines. The presses are mounted on steel cross beams secured to and supported by steel beams running the length of the press line. These longer beams rest on the concrete or steel pillars.

In effect, this new type stamping plant is a two-story building with the second story about 17' above the first story.

One obvious advantage of this type of construction is that most of the press inspection

Fig. 2. The Hamilton under-drive type, triple action lead press has a capacity of 2140 tons with a bed area of 100" x 200".

and maintenance work is done at the maintenance or lower level and does not interfere with production work at the operating level.

The accessibility of the working press members — hanging down into the lower level — permits maintenance people to patrol the area and spot potential trouble before it reaches the critical shut-down stage. Thus, the repair work can be scheduled at a time when it interferes least with production. Being in a more or less secluded area, the inspection checking can be done more safely because scaffolding and ladders are not needed. This is equally true of the maintenance work itself, because dismantled parts do not clutter up the main working areas.

Heavy press members can be handled at the lower level by the use of lift trucks and chain hoists attached to the operating-floor support beams. In the event of a major breakdown of the press drive members, they may be removed from the press and spread out on the floor of the lower level for checking and repair without any indication on the operating level that there is a breakdown.

In many cases, it has been possible to remove the die from a press being repaired, place it in the next press in line, and keep the line running by feeding the stampings right through the die space of the press that is out of service.

Relegating maintenance work to the basement leaves the main floor clear of obstructions that would interfere with the smooth flow of material. The overhead cranes at the production level are not tied up with the maintenance operation and are free to move press dies, coiled or stacked stock, or finished stampings. With the press drive below main floor level, the apparent press height is reduced and consequently the building height can be reduced to provide just the clearance needed for the materials-handling cranes. From a safety standpoint, the lower ceiling height on the operating level makes it easier to provide adequate lighting for press operators and die setters.

Scrap disposal through the lower level is a worthwhile feature that can be provided for with the under-drive press. A very large part of the prime metal brought into a stamping plant goes out as scrap. Removing this scrap at the production level has been a major headache in the past. It interferes with production, takes valuable operating space, and is dangerous. With the present two-level type of plant construction, the scrap can be removed through the lower level without interfering with production. An automatic disposal system can be installed that carries the scrap immediately to a baling station, or the scrap can be transported by lift trucks completely segregated from the movement of stock to be processed.

With all the advantages offered, there is no question as to whether under-drive presses should be installed in a new plant. The important question is, "Can management afford to keep its old plant with top drive presses, or should new plants designed for under-drive presses be planned to replace the old as fast as possible?"

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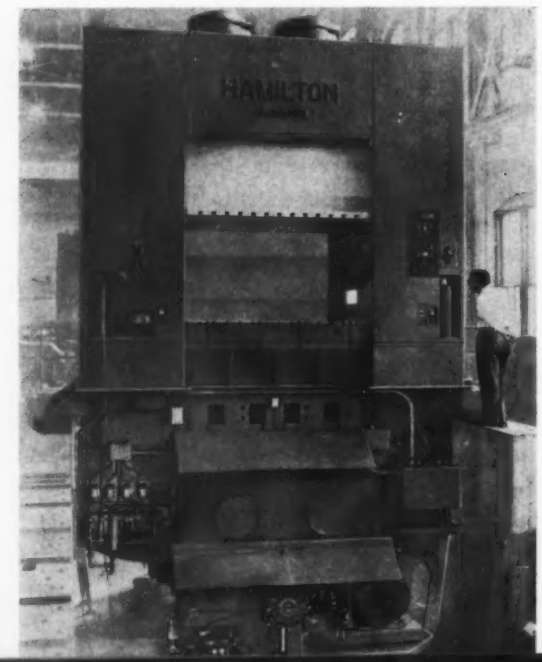

Fig. 3. This Hamilton 500-ton, single action, under-drive press was designed for performing secondary stamping operations in an automotive press line. The under-drive portion of the press shown below the die area extends into the lower plant level.

Plastic-faced, drop-hammer die pair with successfully finished panel parts. Parts are stamped from 0.064" thick 61S-O aluminum.

Plastic Facing Lowers Costs of Drop-Hammer Dies

*by Dwight Peerman and W. L. Minarik**
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PLASTIC TOOLING, with its many advantages and useful features, is finding increasing application in the metalforming industries. Despite its short history, plastic tooling has become a standard major tooling operation in both the automotive and aircraft industries.

Plastics are firmly established as materials of construction for a wide variety of tools and dies. These include: models, such as master models and patterns, Kellering patterns, and duplicate models and patterns; tools, such as spotting, checking, and assembly forms; trim, welding and routing fixtures, and drill jigs; and dies, including draw dies, stretch forms, press blocks, and others.

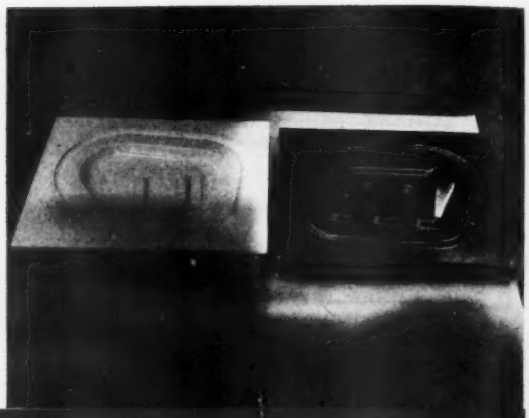
One of the latest successful applications in tooling is the use of plastics for drop-hammer dies. The use of polyamide-epoxy combinations for plastic facing or capping of drop-hammer dies is a recent innovation jointly developed by General Mills, Inc. and the McDonnell Aircraft Corporation of St. Louis, Missouri. Construction of the die utilizes cast plastic facings on Kirksite backings or cores.

Versamid polyamide-epoxy combinations have been found increasingly useful in a wide range of plastic tooling applications including models and patterns, laminated production tools, and metalforming dies. A recent development, the use of polyamide-epoxy combinations for plastic drop-hammer dies, is described herein.

Although plastics have been used in the past for drop-hammer dies, the development of high impact resistant thermosetting blends based on polyamide-epoxy combinations has opened up a much brighter future for such tooling.

Epoxy resins are manufactured by several companies including Bakelite Division of Union Carbide & Carbon Corp., Ciba Company,

*Mr. Minarik, formerly with General Mills, Inc. Research Laboratories, is currently associated with H. B. Fuller Company of St. Paul, Minnesota.



Shell Chemical Company, and Devoe & Raynolds Co., and are extensively employed for plastic tooling either directly or in compounded tooling resins marketed by various formulators. Generally, the more fluid epoxy resins, Epon 815 (Shell), ERL 2795 (Bakelite), or Araldite 502 (Ciba) are preferred because of their better handling characteristics. Polyamide resins which are reactive with epoxy resins are produced by the General Mills Chemical Division and sold under the trademark, "Versamid".

The Versamid-epoxy plastic-capped, Kirksite drop-hammer dies developed at the McDonnell plant feature one die surface made of hard plastic and the other made with a soft and resilient plastic. This allows construction of the die pair without the necessity of allowing for metal thickness.

Construction of an experimental die at the McDonnell Aircraft plant is depicted in the accompanying illustrations. The techniques can be varied to suit different situations but those shown can be considered representative. The die in the illustrations is not a standard production item but an experimental form which represents some of the most severe conditions that might be encountered in drop-hammer die service. The part measures about 8″ x 12″ with a total die surface of about 17″ x 20″. The maximum depth of draw is 1″ and the form features 16 bends over one cross section including radii of curvatures as tight as ⅛″.

Cast Kirksite cores were used in the procedure described. However, experience has shown that the unique properties of Versamid-epoxy blends allow wide liberties. Flat aluminum castings have also been found acceptable as back-up plates. In other tests, solid plastic drop-hammer dies using no metal backing have been tried and found promising. The latter possibility is especially intriguing because it presents an opportunity to make drop-hammer dies in one economical operation.

The techniques used in constructing the illustrated drop-hammer dies are simple and can be readily followed in most tooling shops. Male and female Kirksite cores were first roughly cast. The surface of the Kirksite that was to receive the plastic facing, was cleaned and roughened by sandblasting. The cleaned surface was immediately protected from oxidation by application of a Versamid-epoxy coating. This was applied as a solvent solution and allowed to dry and harden (Fig. 1). A Versamid-epoxy coating is especially recommended for this application because of its unique adhesion, toughness, and strength.

The final plastic-capped female die shown in Figure 4 was made hard, while the male punch was made soft and resilient. To define the surface of the hard female die half, a male plaster model was employed. This had been cast from a plastic master female shape (Fig. 2).

The plaster model was treated with a sealer followed by successive layers of wax, polyvinyl alcohol, wax, and finally a film of silicone mold release agent. Generous use of mold release agents is especially necessary because of the exceptional adhesive qualities of Versamid-epoxy systems. Dow Corning DC-20 has been found to be one of the most effective release agents and is especially recommended as a final layer.

The resin formulation for facing the female die half consisted of a blend of 4 parts Versa-

mid 125, 6 parts epoxy resin, and 5 parts atomized aluminum powder filler (ratios by weight). This formulation gives maximum compressive strength and impact resistance coupled with best handling characteristics. Ingredients, 15 lbs worth, were thoroughly mixed before pouring.

The plastic facing was cast on the female precoated Kirksite backup casting, by pouring the mixed resin blend into a cavity formed by spacers between the plaster master and the Kirksite core supported by plaster as illustrated (Fig. 3). The spacers are so dimensioned as to result in a plastic female die facing about ¾" thick, although the thickness can be varied between wide limits.

The casting was given a preliminary set by first curing at room temperature for 8 hrs. A final cure of hardening of the resin was obtained by curing for an additional 8 hrs at 150° F. This cure schedule is probably twice the minimum needed. However, it was a convenient schedule because the die half was cast in the afternoon and allowed to cure until midnight; the midnight crew placed the casting in the oven at 150° F, and the day crew removed it the next morning and allowed it to cool. The finished female die, after removal of the plaster and plaster form, is pictured in Figure 4.

The finished female die was next prepared for the casting of the soft male punch. The surface of the female was first coated with DC-20 mold release, which was rubbed and polished onto the surface in several layers. The male Kirksite core, which had been previously sandblasted and coated, was positioned vertically . . . facing the finished female die face. Spacers provided for casting the male punch plastic facing ½" thick against the Kirksite. However, this thickness can be increased as experience dictates.

The soft punch formulation was subsequently cast and cured (Fig. 5) in a manner similar to the technique used for the female die half. The soft and resilient characteristics of the male punch precluded the need of allowing for metal thickness thereby effecting a saving in construction costs.

To achieve such characteristics, resin formulation for the male punch consisted of a blend of 60 parts of Versamid 125 to 40 parts of epoxy resin by weight. This combination gave a resultant hardness of 45 on the Shore Durometer, Type D-2. It is desirable to vary the softness of the punch depending on the nature of the forming job. Harder metals, deeper draws and sharper radii generally require a harder punch ranging up to Shore D-2 hardness of 50 to 60. Softer punches with hardness as low as 30 Shore D-2 can be used for comparatively easy jobs. Experience offers the most help in determining the optimum softness of the punch.

Following the cure of the male die facing, the back surfaces of the Kirksite cores of the die pair were machined in order to obtain parallel faces. The die pair was subsequently placed in a Ceco drop hammer and used to make a series of successful part panels (Fig. 6). The panels were stamped from 0.064" thick 61S-O aluminum.

Each part was initially over-formed using one-inch sponge rubber under the part. The part was then heat annealed to the SW state and stored under refrigeration. Next, it was trimmed inside of the trap bead and finally set by one or more blows in the Ceco stamp.

Fig. 5. Casting core punch facing on male Kirksite backing. Casting is made directly against the female die backing.

Drop-hammer dies faced with Versamid-epoxy plastic combinations can be used for the toughest tooling jobs. The facing on such dies absorb the extremely high stresses occurring in drop hammer forming without chipping, cracking or wearing. The plastic facing produces smooth, wrinkle-free, high quality parts — superior to those possible with metal faced dies. Furthermore, Versamid-epoxy combinations do not age or work harden and become brittle as do some plastics which have been tried for drop-hammer die facing.

Above all, the expensive hand barbering, grinding and scraping necessary with conventional metal-faced dies is eliminated. Plastic-faced and solid plastic drop-hammer dies can be made quickly and accurately with a minimum of tools and equipment. Highly skilled labor is not needed and only a minimum of experience and training is needed to turn out excellent dies. Finally, Versamid-epoxy systems are easy and safe to handle and produce dies which are light, acurate, dimensionally stable, and durable.

THE OLD AND THE NEW

Early experiments in applying a plastic facing to Kirksite or other core material for drop-hammer dies, were attempted using Versamid 115. The relatively new entry in the plastics tooling field, Versamid 125, is much less viscous than the earlier tooling resin, 115, and consequently is much easier to handle. The 125 resin blends well with epoxy resins for various tooling applications.

COMPARATIVE SPECIFICATIONS

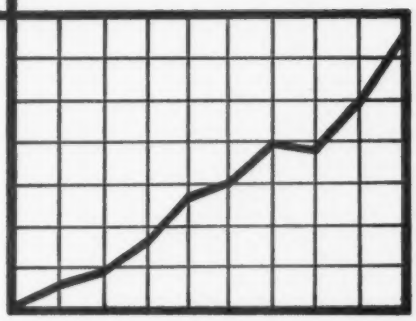
	Versamid 115	Versamid 125
Amine Value	210-230	290-320
Gardner Color	NTD 12	NDT 12
Brookfield Viscosity 40°, #6 Spindle, 4 rpm	500-7750 poises	80-120 poises
Pounds per Gallon	8.3	8.3

end

Fig. 6. Plastic-capped die pair set up in drop hammer showing finished preliminary parts used on tool tryout.

A SCIENTIFIC MANAGEMENT ARTICLE

The Principles of INVENTORY MANAGEMENT *that Lead to Higher Profits*



by Nyles V. Reinfeld
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Executive Services
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PART TWO

REORDER POINT ANALYSIS

THE PRECEDING SECTIONS have discussed the problem of **how much** to order at a time. This section will consider the problem of **when to order,** or at what stock level.

A typical practice is to show a minimum (or "min") point on the inventory card, such that when stocks reach this level they are to be reordered.

The min point is based on the lead time, or length of time it takes to obtain the stock, plus an allowance as protection, against unusual usage of that stock during the interval of the lead time.

The cushion or protective stocks are conventionally set up as a fixed amount for all stocks. For example, one firm uses a one-month safety or cushion for all stocks in its distant warehouses. The government back-up depots use a one-year stock level as the min point. Hence, if the lead time for the items stocked in these depots averages three months, the cushion is nine-months supply. Other firms establish their safety allowance or reserve stocks as a percentage of the usage during the lead time. A typical figure is 33%. Thus, if 100 units are used during the lead time, the cushion is set at 33 units.

These methods, just considered, represent the principal ways in which the reorder point is established. There are others, but essentially the techniques are the same.

The proposed scientific method for establishing reorder points and reserve stocks will be compared to the conventional method to show the value of applying more-scientific principles to these problems. It will be shown, for example, that a fixed safety allowance does **not** give the same protection for all items. Because of the variation in protection obtained by conventional methods, some stocks are insufficiently protected against stockouts, and others are over-protected. In contrast, the methods to be described will not only increase the protection against stockouts, but will generally tend to **decrease** the total inventory. The results are a better balanced inventory, better customer satisfaction, and lower stock levels.

To revert to a diagram, the safety allowance and reorder point can be seen to be interrelated as shown in Figure 8 below:

In Figure 8, the usage during the lead time is 100 units as shown at the left. The lead time is two weeks and the safety allowance has been set at 25 units.

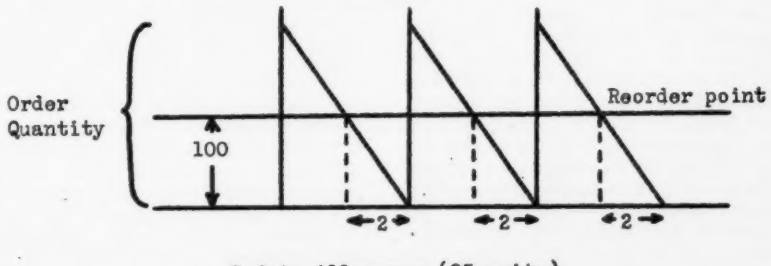
Hence, the reorder point is at 125 units (usage during lead time plus cushion or safety).

From the diagram, it is seen immediately that the reorder point is dependent upon the cushion. Thus, if we determine one, we automatically have determined the other. In the case above, the safety allowance is 25% of the usage during the lead time, or one-half week's supply.

Since the reorder point and cushion are a function of usage during the lead time, the order quantity can be computed independently of the safety allowance. Hence, we were able to treat the order quantity analysis as an independent section.

There are two clear-cut approaches that can be used in applying modern techniques to reorder point analysis. Although each approach involves a similar philosophy or concept, the areas in which to apply one or the

FIGURE 8



other is usually well defined. There is, thus, little problem in selecting one over the other. Each will be discussed separately in detail.

The two approaches may be classified as follows:

1. Setting reorder points on the basis of probability of stock-outs, and
2. Setting reorder points on the basis of cost of stock-outs.

Briefly, the philosophy behind both methods may be described as follows:

The reason for carrying a cushion in inventory is that sales or usage will seldom be exactly the estimated usage during the lead time. Normally, we will use more or less than the expected amount. We are not too concerned with using less than the amount predicted. To protect ourselves against those instances in which more stock will be used than expected during the lead time, we allow a margin of safety which we call protective stock.

The fluctuation of usage below or above the expected usage will usually follow a pattern known as a Poisson distribution. The Poisson distribution has been found to be particularly appropriate to problems involving sales and usage. Although there are exceptions where usage will not follow such a distribution, the majority of the cases will. There are mathematical methods for checking usage to determine whether it is Poisson or not, but usually: (1) The usage pattern is obviously abnormal; or (2) The application of these techniques breaks down under trial or experience. Fortunately, many distributions are similar for average usages, so that application of these techniques to most industrial inventories will be completely satisfactory. The value of the Poisson distribution is that it approximates sales under conditions of very small usage, as well as large usages.

The Poisson distribution may be described most simply by referring to the scatter of a rifle. If the gun is mounted and fired a number of times, there will be a dispersion of shots around a center point. Such dispersion can be shown to be a Poisson distribution. Hence, by reference to Poisson tables, it is possible to show the probability of a shot falling more than a certain distance from the center.

The average stock usage during the lead time gives the center point. By use of the Poisson distribution, it is possible to predict the probable dispersion around this average and, thus, to predict the probability of using more than a certain amount of stock. By adding units into stock as a cushion, we are decreasing the probability of the dispersion exceeding the stocks on hand. The cushion can therefore be determined on the basis of the probability of running out of stock. If we can compute the cost of each stock-out, we can balance the cost of carrying the cushion versus the costs of stock-outs.

In this way, the cushion can either be set up solely as protection against stock-outs, based on probability, or it can be set up to produce the minimum cost, on the basis of probability.

Setting Reorder Points as the Basis of Probability of Stock-Outs

It is easily seen that not all products require the same protection against stock-outs. This condition is true even in the military situation where it is often (and convincingly enough) argued that the military forces can **never** afford to run out of stock. The truth of it is, however, that running out of some items has little or no effect on the operation. Running out of critical bearings used in jet engines is serious; running out of brooms is of little import to a battle.

Likewise, Industry has important customers and products in which stock-outs present serious problems in customer relations. Stock-outs in other items, such as "cat-and-dog" lines, may be completely acceptable and even expected by the customer.

Here, and also in applying the economic order quantity formula, it is advisable to catalog the inventory in terms of an item's importance, under such headings as "critical", "major" and "minor". Products are then given the protection warranted by their importance and established by company policy.

Although it may seem desirable to "never" run out of stock on any item, never running out of stock theoretically implies an infinite amount of stock. Even the best protected items run some outside chance of being depleted under exceptional conditions.

Consistency of protection is much more important than excessive protection in one case and insufficient protection in another. Production is expensive. The best functioning inventory system will plan for some stock-outs. For example, in a study made at the Bell Telephone Laboratories, by R. H. Wilson, the following inventory requirements were estimated as necessary to give a desired protection:

An Average of One Stock-Out	Inventory Required
Every year	$ 76,000
Every two years	100,000
Every five years	134,000
Every ten years	167,000
"Never"	276,000

Since the inventory carried for protection is fixed, the whole amount is carried in stock. Thus, the carrying charge is applied to the whole amount rather than one-half as is the case with the turnover inventory. An equivalent reduction in safety stocks produces twice the savings as the economic order quantity.

The method for determining the reorder point has been reduced from a complicated formula to a simple chart, Figure 9.

To read the chart, we must know the average usage of a product during the lead time and the company policy on stock-outs. Given these factors, we can then enter the chart and find the reorder point.

An example will help to illustrate the procedure:

A jewelry store sells an average of 20 cigarette lighters a week. On Monday of each week, the salesman drops in to fill the order the jeweler placed the previous Monday. How many lighters should the jeweler start with each Monday so that he will run out of stock an average of only once every two years?

On the basis of 50 weeks in a year, the jeweler will accept stock-outs once every 100 times. In other words, he will accept stock-outs 1% or less of the time.

The average usage during the lead time or replenishment period is 20 units. In Figure 9, select 20 across the bottom of the chart, and read up the left hand column marked "percent of times you will accept stock-outs" to 1%. Where the 20 on the bottom and the 1% intersect inside the chart, place your pencil point. You will note that there are a number of curved lines marked with "C = 0, 1, 2, 3, etc.". The pencil point falls between the curves C = 30 and C = 35. Interpolating between these curves gives the answer, C = 31. The C-curves are the reorder points. Hence, the jeweler should reorder to have 31 units at the start of the week. Since he uses 20 units each week (on the average), he is therefore carrying a cushion of 11 units. This cushion protects him 99 times out of 100 against stock-outs. The cushion is 55% of the usage.

In another case, the usage is 100 units during the lead time (or replenishment period) and again the acceptable number of stock-outs is one every 100 times, or 1/100.

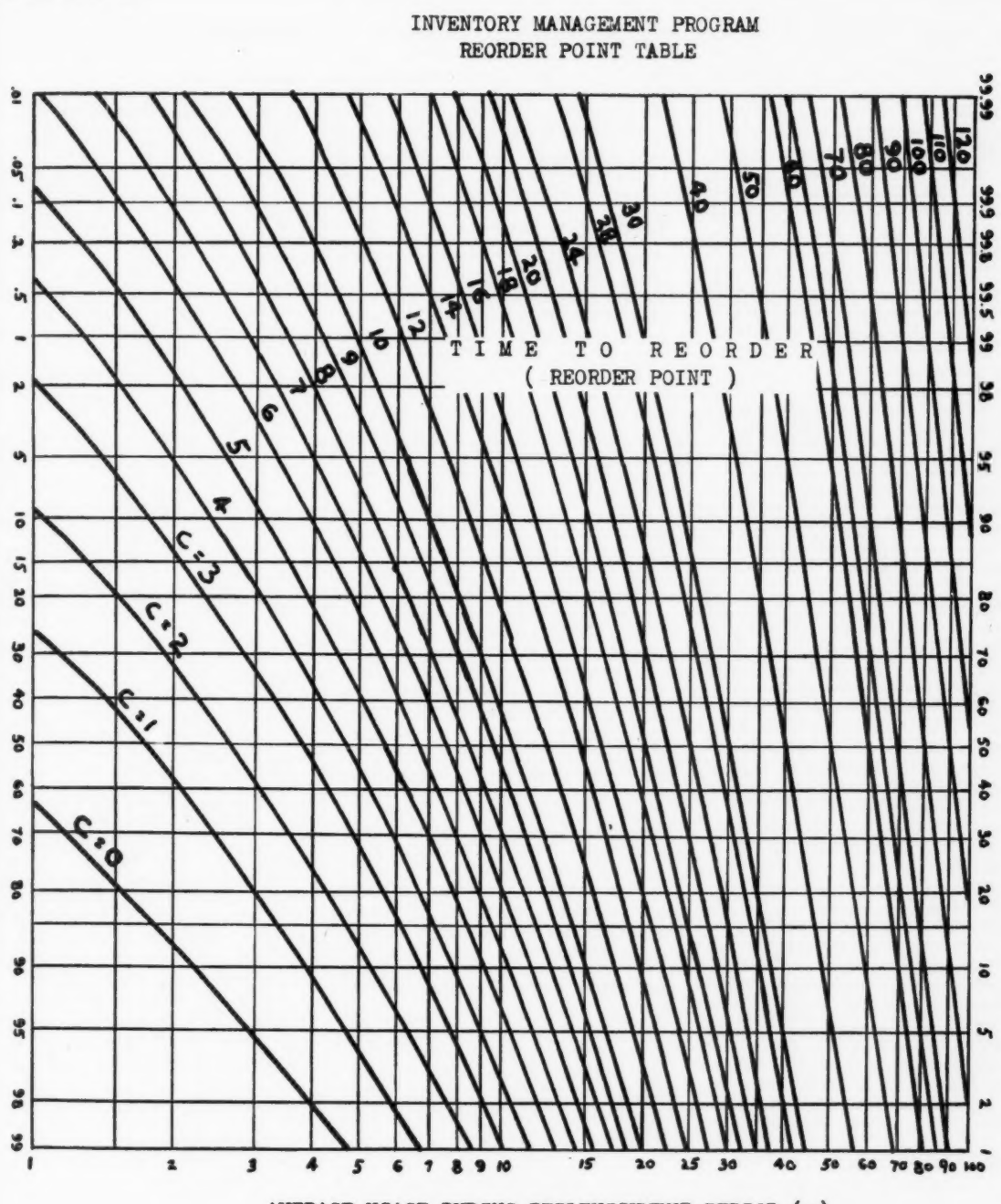
Reading the 100 from the bottom of the table and 1% from the left side, we find that the answer is C = 122.

The cushion is therefore 22 units or 22% of the usage.

Consider one more example:
Usage during lead time = 1 unit
Accepted probability of stock-out = 1%

Use of the chart shows that C = 4 units. We select C = 4, because the answer falls between C = 3 and C = 4 and the answer must be in terms of whole numbers. In this example, the cushion is 3 units and 300% of the usage.

These three examples should serve to illustrate that a fixed cushion does **not** give equal protection to the inventory. In the examples cited, the cushion varied from 22% to 300% depending upon the usage. The ap-



To read: Select desired protection against stock-outs, move across chart to average usage, and read off proper reorder point.

$C = a + d\sqrt{a}$

FIGURE 9

propriate cushion is thus a function of lead time usage and probability.

It will also be observed that the fast movers tend to require less cushion for the same protection than slow movers. As a result, application of these techniques will increase inventory on slow movers and decrease it on fast movers. The increase on slow movers improves the protection with little effective increase in total stocks. The decrease on fast movers reduces inventory greatly with little effect on protection. Conversely, a fixed safety stock gives too much protection to fast movers and too little to slow movers.

In a recent study, it was shown that a fixed cushion permitted about 18 stock-outs a year out of every 20 items carried in inventory. In other words, there would be almost one stock-out for every item carried in inventory. Actually, what happens is that some items will run out of stock many times during the year and others will seldom if ever be depleted.

The study showed that stock-outs

could be reduced to a fraction of present stock-outs and that protective inventory could be reduced to 25 to 30%, using the techniques just discussed.

For purposes of comparison, one might take a look at present policy and show the protection that is actually being obtained.

For example, assume that company policy has dictated a one week safety or cushion. For both product A and B the lead time is one month. The usage of A is 100 units during the lead time and the usage of B is four units during the lead time. What protection are you getting for these products?

To analyze the problem we first note that the cushion for A is 25 units. Therefore, the reorder point for A is 125 units. In other words, C = 125. Similarly, for B, the cushion is one unit and C = 5.

The next step is to refer to the chart, Figure 9. For A, the usage is 100, which is read from the bottom of the table as before. Since C = 125, we read up from the 100 at the bottom until it intersects with the curve C = 125. (Actually, there is no C = 125 on the chart, but it falls between C = 120 and C = 130.) Putting the pencil point at this intersection, read the percentage at the left of the chart that intersects with the pencil point. The answer is approximately 0.3%. In other words, for product A, the one-week safety gives very good protection. Item A will run out of stock only three times in every 1000 ordering cycles!

For item B, four is read from the bottom of the chart to get the intersection with the curve, C = 5. The intersection coincides with 22% on the left side of the chart.

Hence, the one-week safety for product B means the item wil be out of stock 22 times per 100 order cycles.

In other words, item A has about 77 times the protection of item B, both of which have the same cushion. Depending on the type of industry, either item could be of critical importance.

Using The Correct Units

It is important that the correct units be used in setting the reorder point. In many lines, a product may be sold in rolls or packages. Paper, for example, may be sold in reams or packs. The usage should be computed on items such as these in terms of the packs used rather than the number of pieces.

To illustrate, suppose the usage during the lead time is 100 pcs, but that each sale is in packages of 5 each.

If the acceptable probability of stock-out is 1%, we can compute the reorder point and safety allowance.

If we use 100 as the average usage, we find that the reorder point is 122 and the cushion is 22 pcs. (See previous examples.)

If we use 20 packs as the average usage, we find that the reorder point is at 31 packs with a cushion of 11 packs. In terms of pieces, the cushion is 55 pcs.

The correct answer is to use packs to determine the reorder point when packs represent the usual way in which the material is sold.

Relationship To Order Quantity

In the discussion on order quantities, there were three examples: In Example 1, the correct policy was to order four times a year; in Example 2, the correct policy was to order once a year; and in Example 3, the correct policy was to order 10 times a year.

In any actual case, the only chance of stock depletion (other than through clerical errors) is after the stock has been reordered. In other words, you can only run out of stock while you are awaiting replenishment. Hence, in Example 1, there are four times a year in which there is a possibility of stock-outs. If company policy states that they will accept stock-outs once every five years, then for Example 1, there are 20 times in the five-year period in which stock will be reordered. Thus the company will accept stock-outs once every 20 replenishment periods or 5% of the time.

Using the same five-year policy for other examples, the company will accept stock-outs once every five replenishment periods for Example 2, and once every 50 replenishment periods for Example 3.

Hence, a consistent protective policy means that the safety allowance must be tied in with the ordering cycle, which is given by the order quantity.

To summarize, based on a five-year protective policy we get:

	Order Qty. in Months	Cycles/ Year	Acceptable Stock-Out Percentage
Ex. 1	3	4	5%
Ex. 2	12	1	20%
Ex. 3	12	10	2%

Once these percentages have been computed, the table, Figure 9, is used as before, using these percentages to get the reorder point.

The Cost Of Running Out Of Stock

The method employed here is essentially the same as that discussed in the preceding sections on reorder point. The one exception is that it is assumed that the cost of stock-outs can be obtained. In many cases, it can.

If possible, it is desirable to work from a cost standpoint since the solution is in terms of economies. The method described here balances the cost of carrying the safety allowance versus the cost of stock-outs, at a considerable overall reduction in total cost.

Rather than bore you with the derivation of the formula, it will merely be stated that the derivation is much the same as that used in the section on economic order quantities.

The formula for cost of stock-outs, based on probability is

$$\text{Formula 4.}\quad p^* = \frac{100\ N\$ \times I \times C}{12\ M\ K}$$

where p^* is the aceptable percentage of stock-outs (to get least total cost), and K is the cost of running out of stock. The other terms have the same meaning as before: Namely, N$ is the order quantity in dollars, I is the carrying charge, C is the cost per piece, and M is the monthly usage at cost.

An example will help illustrate its use:

M = $1,000 K = $3
C = $1 Usage during L.T. = 100
P = $10 units
I = 1/6

Solving the economic order formula, given earlier,

$$N\$ = \sqrt{\frac{24\ P\ M}{I}}$$

we get

$$N\$ = \sqrt{\frac{24 \times 10 \times 1000}{1/6}} = \$1{,}200$$

Since we now have N$, we can solve Formula 4:

$$p^* = \frac{100 \times 1200 \times 1/6 \times 1}{12 \times 1000 \times 3} = .56\%$$

In other words, the most economical program is to permit stock-outs .56% of the time.

FIGURE 10
Table to Extend Reorder Point Chart
(Use Formula: $C = a + d\sqrt{a}$)

d	Acceptable % of Stock-outs
4.0	"Never"
3.5	.023
3.0	.135
2.8	.26
2.6	.47
2.5	.62
2.4	.82
2.33	1.00
2.17	1.50
2.06	2.00
1.96	2.50
1.89	3.00
1.82	3.50
1.76	4.00
1.65	5.00
1.56	6.00
1.48	7.00
1.41	8.00
1.35	9.00
1.29	10.00
1.16	12.50
1.04	15.00
1.00	15.87
0.85	20.00
0.68	25.00
0.53	30.00
0.39	35.00
0.26	40.00
0.13	45.00
0.00	50.00

For any percentage between those shown, interpolate to get d. The answer will give a value of d just slightly greater than the exact answer, and hence, slightly greater protection.

At this point, the carrying costs and stock-out costs are in balance.

Using .56% as the acceptable percentage of stock-outs and 100 units as the usage, Figure 9 shows that the reorder point will be 124 units. The safety is 24 units.

Extension Of Chart

Figure 9 only covers a usage of 100 units or less. **For higher usage, the chart cannot be used as is.** It is thus desirable to extend the chart to comply with those cases involving greater usages.

At the bottom of Figure 9 is a formula $C = a + d\sqrt{a}$. This formula is known as the square root approximation to the Poisson Distribution. The Poisson Distribution for usages larger than 20 is very close to the Normal Distribution.

Hence, it is possible to approximate the answer for the Poisson by use of the Normal. Where the usage exceeds 100 units, use the formula from Figure 9 and repeated in Figure 10.

In the formula, C is the reorder point, as before, and "a" is the average usage during the lead time. The letter "d" is determined from Figure 10.

As in the other problems, to get the reorder point, we need to know the usage during the lead time (a) and the acceptable percentage of stock-outs. This percentage is then converted to a decimal.

For example, in one case $a = 100$ and the percentage of stock-outs accepted was 1%.

To find d, select from the right-hand column of the table the figure 1% or 1.00 and read the corresponding value of d. This figure is 2.33. Hence, for an acceptable stockout of 1%, $d = 2.33$.

Feeding the appropriate values for a and d into the formula $C = 100 + 2.33\sqrt{100}$, we get $C = 123$. In other words, the reorder point is at 123 units, with a safety allowance of 23 units.

When the same example was solved using Figure 9, we got a reorder point at 122 units. The slight discrepancy is due more to a slight inaccuracy in the chart, plus difficulty in reading, than in the approximation. However, the chart is sufficiently accurate to apply to inventory without concern.

To summarize, it is only necessary to find the usage during the lead time and the acceptable probability of stock-outs to get the reorder point. Thus, the data required is the same as that required to use Figure 9. Either reorder point method may be applied.

In our next month's issue, Mr. Reinfeld will conclude his article with a discussion of Miscellaneous Inventory problems, including Safety Allowances in Continuous Production.

SERVO AND FEEDBACK PRINCIPLES EXPLAINED

by Fred L. Kahl
Application Engineer
Chicago Office
GENERAL ELECTRIC COMPANY

HOW CLOSE ARE YOU to a servo-mechanism right now? Does it have feedback? Do you own one or have you ever used one?

You have been hearing the terms servo-mechanism and feedback and will undoubtedly be hearing it many more times before this is over. Nor will it stop there. You will hear it in connection with automation until someone thinks up a new name to confuse us all over again.

Some of you of course know what a servo-mechanism with feedback is and how it works. For the rest of you, don't let the name confuse you because you have a whole handful of servo-mechanisms with feedback right in your own hand.

A servo-mechanism is a power device that will respond to a small signal. The output of this power device may be of flea power or elephant power so long as the control signal is small in proportion. As an example let us use one of the servo-mechanisms you always have with you—one that is equipped with feedback, your fingers, your arms or your legs.

Your arm is a power device that is controlled by a small signal from the brain. Let us send a signal to our left arm to raise until it is horizontal. The signal starts the raise muscles contracting and the arm starts up. Why does it stop in the horizontal position, why does it not continue on up until it bumps your head? The answer is **feedback!** The nerves in your arm send back a position signal telling your brain when you are approaching the horizontal position so the raise signal can be reduced in speed. Then, when the arm arrives at the horizontal position, the raise signal is cancelled and only enough signal is maintained to hold the arm in that position.

Some automatic machines need more than one form of feedback, for greater accuracy or greater speed. This time while we are raising the arm let us also look at it. We will now also receive a feedback signal from our eyes, a photo-electric signal. By looking at the arm we can more accurately locate it in a horizontal position. If I were to place my hand on the edge of the rostrum and then with my eyes shut raise my hand 6", my feedback nerves would tell me when I had raised the hand about 6". Then by looking at it I could more accurately position the hand.

The human analogy of a servo-mechanism with feedback could be carried to great lengths. For example: — Let us say we are driving a car on U.S. Highway 12. Your eyes are acting as a photoelectric template follower following the correct side of the highway and the highway signs for turns, stops and speed limits. When you start, you signal your right foot to press on the accelerator. A feedback from your foot tells you when you have depressed the accelerator to the floor. A feedback from your body tells you that you are accelerating too fast, and a feedback thru your ears tells you the engine is laboring too hard. So, you release the pressure on the accelerator to where the acceleration is more comfortable and the engine noise is not excessive. When the speedometer approaches the desired speed, your eyes feed back a signal to release the pressure on the accelerator still further, finally regulating it to hold the desired speed.

When you come to a turn sign, the eyes signal the brain to slow down. It interprets that signal and sends the control to the right foot to move from the accelerator to the brake and apply X pounds of pressure to slow down gradually. The nerves in the foot feed back the pressure signal to stop the application of any more pressure. Your eyes feed back the speedometer speed signal and, when it is low enough, pressure on the brakes is released, and so on around the turn, and down the road . . . just one feedback after another.

The feedback system in your arm is a good one. It permits rapid movement with a definite slow down as it approaches the specified position permitting a stop without over shooting the mark. This is a real problem in many forms of servo-mechanisms. If they are set for high sensitivity or high speed, they often overshoot and some times hunt back and forth without being able to stop on the mark.

The servo-mechanism with feedback used in automation is composed of a number of components coordinated into a system. It is not so well integrated and coordinated as the system of your arm; therefore, it has more limitations and difficulties.

The first unit in a servo system is the source of the signal or the storage of the signal which could be any of the following:

a. Punched cards
b. Punched tapes
c. Magnetic tapes
d. Templates
    1. Two-dimensional
    2. Three-dimensional

*Talk delivered before "Progress through Automation" management conference recently held at the International Harvester Company's Manufacturing Research Lab in Chicago, and presented here through courtesy of that company.

e. Drawings for photo-electric template followers

The second part would be the unit to interpret the signal and put it into usable form (electrical, mechanical or hydraulic). This would be:

a. Card readers resulting in electric signals
b. Tape readers resulting in electric signals
c. Stylus (template followers)
   1. Contact type Off-On electric signal
   2. Pilot valve, hydraulic or air proportional signal
   3. Strain gauge (resistance or magnetic) proportional electric signal
d. Photo-tube with a lens system. Proportional electric signal.

The third is a means of amplifying the signal to usable proportions for either direct power in the mechanisms or to power another amplifier.

a. In the electric system, there is generally an electronic vacuum tube amplifier. In some systems it may be a magnetic amplifier or transistors.
b. In the hydraulic system, the pilot valve may operate the end device direct when low speed and power are required; or, it may operate an amplifier valve where greater capacity and speed are required in the end device.

The fourth element may be an additional amplifier where high power is required. In the electrical system this may be high power electronic equipment, magnetic amplifiers or rotating amplifiers.

The power unit produces the work or motion called for by the original signal. In machine tools and production machinery, we generally utilize this motion either as rotation or straight line motion.

a. The electrical system will end in a motor to produce rotation. This motion thru gears, cranks, racks and screws may be changed into straight line motion if that is required. This motion may be controlled for speed and position.
b. The hydraulic system will end in a cylinder or a hydraulic motor. The cylinder produces straight line motion and may be geared thru a rack to produce rotation, and the hydraulic motor may be geared to produce straight line motion. Either device may be controlled for speed of travel and position.

Up to now we have signaled this servo-mechanism to go forward, and it has responded by going forward. Now, how are we going to control its response? The signal that initiated the motion ahead may have also signaled a speed of 1048 rpm, or it may have signaled to make 32.7 turns. Let us say it did, how are we going to know when that speed or that number of turns have been reached? Yes, by feedback.

Probably the easiest feedback system to understand is the mechanical linkage on a turbine governor. The primary control signal in our governor is the adjustment of the linkages so at a selected speed the flyball position will hold the pilot valve in the closed position. The primary feedback will be the speed of the unit acting on the flyballs and thru the pilot valve to finally control the steam to the turbine and thus its speed. As we study its operation, we find we need a second feedback to make it stable. (This is true of many servo-mechanisms with feedback.) If the flyballs were connected directly to the pilot valve and the load increased, the turbine would slow down a little. The flyballs would move the pilot valve to increase the speed. This would send oil to the main cylinder to open the steam valve. If the turbine did not respond faster than instantly, which it cannot do, the steam valve would be opened too far causing the turbine to over-speed. The reverse operation would then take place and the speed would go to low and then repeat the over and under.

While this system would try to hold exactly the same speed at full load as it does at no load, the operation would be too unstable. It will be necessary to add another feedback to stop the hunting. This addition will spoil the absolute flat speed regulation by making it droop as the load increases, but the operation will be stable.

By connecting a lever arm from the main valve cylinder back to the governor and pilot valve, the steam valve can be made to open in proportion to the error in speed. This not only prevents the valve from opening too wide on a small speed drop but also causes it to move in the close direction as the speed returns toward normal. When speed reaches normal, the valve also reaches the correct opening preventing overshoot and hunting. The amount of anti-hunt, and in this case droop, can be regulated by the length of the lever arm. With the increased load and the resulting droop, the speed will be a little low. This can be corrected by resetting the speed adjustment manually or automatically.

For the speed control on an electric servo-mechanism we will install a tachometer generator and feed that signal back to the first amplifier. Here the original signal and the speed signal are compared. If there is a difference in these two signals, it is called the error. This difference is amplified to bring the speed to the correct value.

When the control signal was first put on, the difference or error was large. This large error when amplified sent full output power to the motor to bring its speed to the required value. As the speed of the motor comes closer to the required speed of the feedback, the signal will come closer to the original signal making the error smaller. When the error becomes fairly small, it starts to regulate and reduce the power input to drive. When power input is just enough to maintain the required speed then the equipment will regulate at this point. There will be a small difference between the setting or control signal and the feedback signal to maintain this amount of power input. The amount of this error will depend on the sensitivity of the system.

Systems requiring a large error will generally be more stable and easier to operate but will have a greater inaccuracy. Systems requiring an extremely small error required to obtain high accuracy may become very unstable. With this type of control the drive approaches so close to the desired speed with full power on, there is not time to reduce this power to the required amount before the drive overshoots its mark and must return, perhaps again too far. It is possible that the drive may be driven over and under speed continuously, never stopping. This is called hunting.

To STOP the hunting we must either reduce the sensitivity and accuracy or add another feedback. This often takes the form of a short time means of slowing down the acceleration. On a big change in speed it tends to delay the acceleration only at the start but does not interfere beyond that until the reversal of control on the overshoot, when deceleration is slowed down while the speed is being brought back to the correct value. On a high sensitivity setting, this may require one or two hunts before the drive will regulate at the desired speed.

If we have a feed mechanism that requires a definite number of turns of the drive motor to advance a tool to a given position, we could use two types of signal — one from punched cards, punched tapes, or magnetic tapes for the drive to make 32.7 turns. An impulse unit or selsyn on the drive counts the turns by fractions, and when the count is completed this feedback count signal cancels the control signal stopping the drive.

The other type of feed is with a stylus to a template. Its operation is similar to the speed control. A fixed bias causes the drive to feed into the work. One-half deflection on the stylus gives a feedback signal just equal to the bias signal, making the error signal zero. This will stop the feed.

A greater deflection on the stylus such as caused by a rise in the template will cause a feedback greater than the bias signal, thus giving a reverse error causing the drive to back out of the work until balance is again attained.

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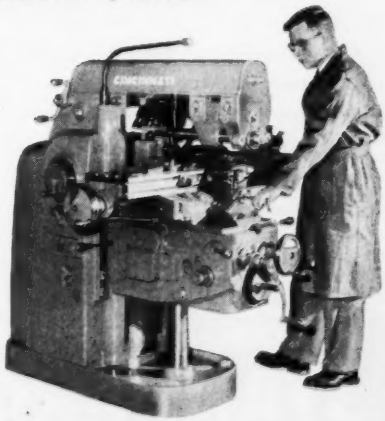

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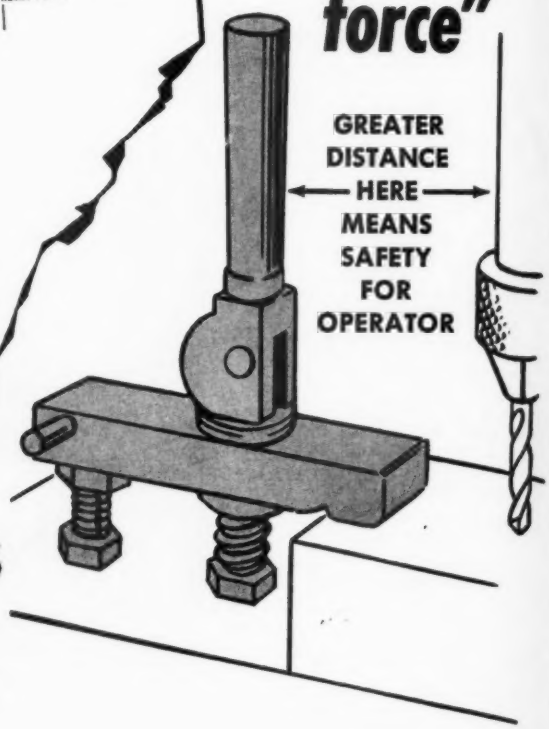

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14	33	54	103	124	142	1541	1601	1661	1703	1753	1813	1862	1911
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A3	A21	A39	A57	A75	B16	B34	B52	B70
A4	A22	A40	A58	A76	B17	B35	B53	B71
A5	A23	A41	A59	A77	B18	B36	B54	B72
A6	A24	A42	A60	B1	B19	B37	B55	C1
A7	A25	A43	A61	B2	B20	B38	B56	C2
A8	A26	A44	A62	B3	B21	B39	B57	C3
A9	A27	A45	A63	B4	B22	B40	B58	C4
A10	A28	A46	A64	B5	B23	B41	B59	C5
A11	A29	A47	A65	B6	B24	B42	B60	C6
A12	A30	A48	A66	B7	B25	B43	B61	C7
A13	A31	A49	A67	B8	B26	B44	B62	C8
A14	A32	A50	A68	B9	B27	B45	B63	C9
A15	A33	A51	A69	B10	B28	B46	B64	D1
A16	A34	A52	A70	B11	B29	B47	B65	D2
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5	24	44	89	113	133	1482	1572	1633	1682	1731	1782	1841	1883
6	25	45	91	115	134	1483	1573	1634	1683	1732	1783	1842	1891
7	26	46	93	116	135	1484	1581	1635	1684	1733	1791	1843	1892
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13	32	53	102	123	141	1534	1596	1653	1702	1752	1812	1861	1906
14	33	54	103	124	142	1541	1601	1661	1703	1753	1813	1862	1911
15	34	55	104	125	143	1542	1611	1662	1704	1761	1814	1863	1912
16	35	56	105	126	144	1551	1612	1671	1711	1762	1821	1871	1913
17	37	57	106	127	145	1552	1613	1672	1712	1763	1822	1872	1914
18	38	58	107	128	146	1553	1614	1673	1713	1764	1823	1873	

EDITORIAL ITEMS

A1	A19	A37	A55	A73	B14	B32	B50	B68
A2	A20	A38	A56	A74	B15	B33	B51	B69
A3	A21	A39	A57	A75	B16	B34	B52	B70
A4	A22	A40	A58	A76	B17	B35	B53	B71
A5	A23	A41	A59	A77	B18	B36	B54	B72
A6	A24	A42	A60	B1	B19	B37	B55	C1
A7	A25	A43	A61	B2	B20	B38	B56	C2
A8	A26	A44	A62	B3	B21	B39	B57	C3
A9	A27	A45	A63	B4	B22	B40	B58	C4
A10	A28	A46	A64	B5	B23	B41	B59	C5
A11	A29	A47	A65	B6	B24	B42	B60	C6
A12	A30	A48	A66	B7	B25	B43	B61	C7
A13	A31	A49	A67	B8	B26	B44	B62	C8
A14	A32	A50	A68	B9	B27	B45	B63	C9
A15	A33	A51	A69	B10	B28	B46	B64	D1
A16	A34	A52	A70	B11	B29	B47	B65	D2
A17	A35	A53	A71	B12	B30	B48	B66	D3
A18	A36	A54	A72	B13	B31	B49	B67	

Which article in this issue was of most interest to you? _____

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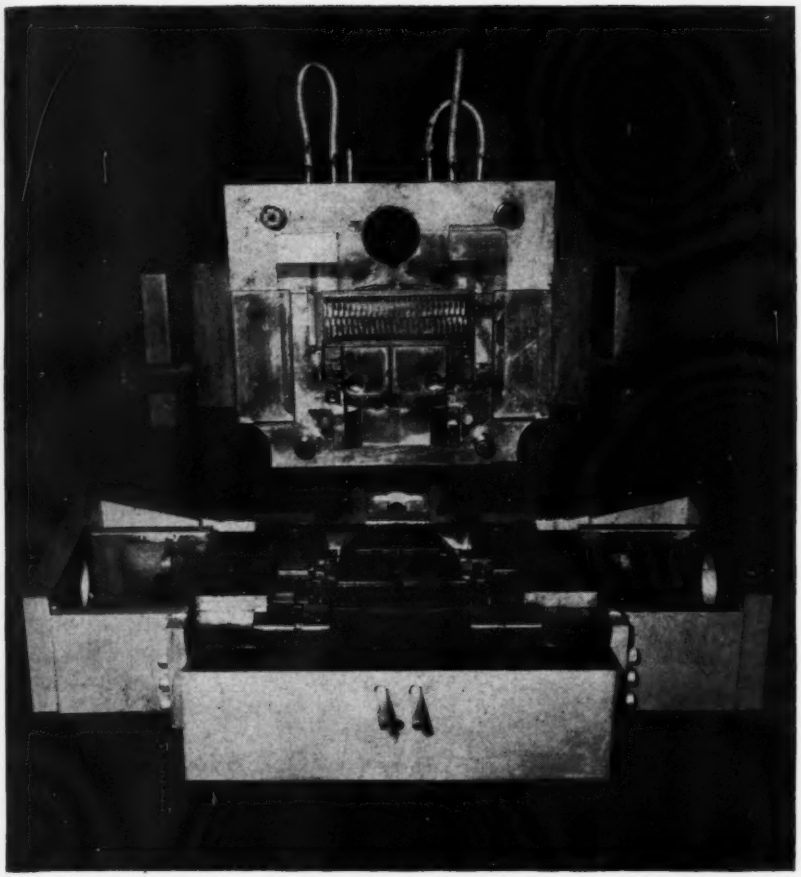
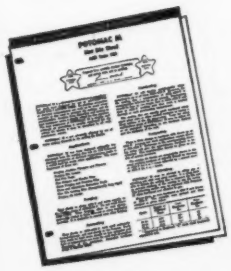


No matter what your DIE-CASTING JOB may be...

Accuracy calls for POTOMAC M Hot Work Die Steel



Write for BLUE SHEET on POTOMAC M

This concise four-page folder gives all needed handling and shop treatment details on Potomac M. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. TP-84

In the precision casting of aluminum, POTOMAC M Hot-Work Die Steel is especially favored as the material for die-casting dies because its properties help assure accuracy of the steel itself *after* heat treatment. Die makers have found that size changes are held to a minimum. Dimensional stability is thus the *first* contribution that POTOMAC M makes to accuracy.

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WSW 6205

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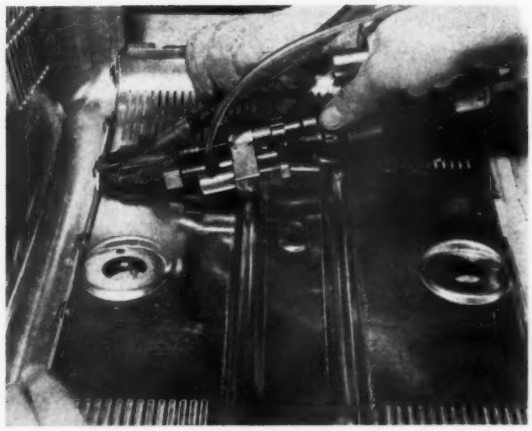
CIRCLE INFORM-A-GRAM KEY NO. 89

Screw Feeder Steps Up TV Case Assembly Job



WHEN A LARGE sheet metal fabricator like Modern Tool & Die Company, 5389 West 130th St., Cleveland, has tooled up for volume production of a major appliance component, and is already working two shifts to keep up with demands, a request that he double deliveries on three days notice may be a mixed blessing.

That was exactly the situation confronting Stewart Waterworth, production manager of the Cleveland firm, when the purchasing department of Philco called him late one Wednesday afternoon and asked that Modern Tool & Die double its daily carload shipments of lacquered sheet metal cases for their popular new Seventeener portable TV sets by the following Monday.

Fastening the top shell closure, which required the placing of 14 hidden screws, seven on each side of the shell, loomed as the one real bottleneck in the whole operation.

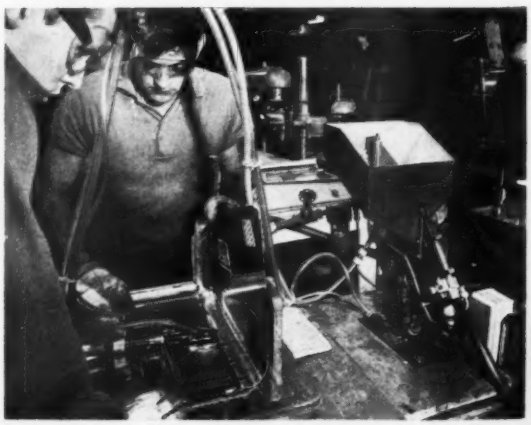
Because of the small size of the fasteners (#6 x ⅜" Phillips round head Type A sheet metal screws and J-type Speednuts) and the way in which the work had to be performed within the shell, the assembly problem had been given special study before Modern Tool submitted its bid for the work. After consulting various manufacturers of stapling and riveting equipment, Waterworth had turned to Pneuma-Serve. Already familiar with this automated screw feeding device, which had enabled them to cut the cost of attaching metal cover plates to power mower mufflers from $32 to $21 per thousand, he found that it offered the only alternative to hand placing and hand driving of screws for the TV case.

When the request to double production came through, two people working with a Pneuma-Serve, feeding fasteners to a single offset power driver, had been assembling 300 units during a 9-hr assembly shift. This meant installing 466 fasteners/hr or nearly 8/min. The trouble was that they only had one Pneuma-Serve unit available for this particular job.

Mr. Waterworth found that he would have to put eight additional people on this assembly job in order to meet the requirements of the new schedule, which called for doubling daily production. He was preparing to do this until such time as an additional Pneuma-Serve unit could be made available. However, George A. Tinnerman Corp., 19930 Detroit Rd., Rocky River, Ohio, the supplier, was then operating on a 6-wk delivery schedule, but managed to adapt a unit for this very special job and had it installed and in operation by Friday afternoon, just 48 hrs after Mr. Waterworth's first call for help. By the time Monday morning rolled around, a second Pneuma-Serve team was already familiar with the operation and working away at the same clip as the original team.

According to Mr. Waterworth, the second Pneuma-Serve not only saved him the wages of six extra operators but a large amount of floor and bench space which would have been required to assemble the TV cases. end

These two men, aided by the automated Pneuma-Serve feeding device, are assembling an average of 300 TV closure units during every 9-hr. shift. The job entails driving 14 sheet metal screws through pre-punched holes into J-type Speednuts. Screws in the hopper on the right are aligned by a special elevating device that drops them into a feeder slot, which leads directly to the plastic tube.



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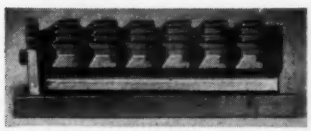
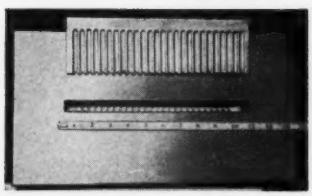


WE SAVED 16 HOURS

plus 9 different operations on this form grinding of a carbide broach.



WE SAVED 379 HOURS

on the machining of this die casting die.

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CIRCLE INFORM-A-GRAM KEY NO. 91

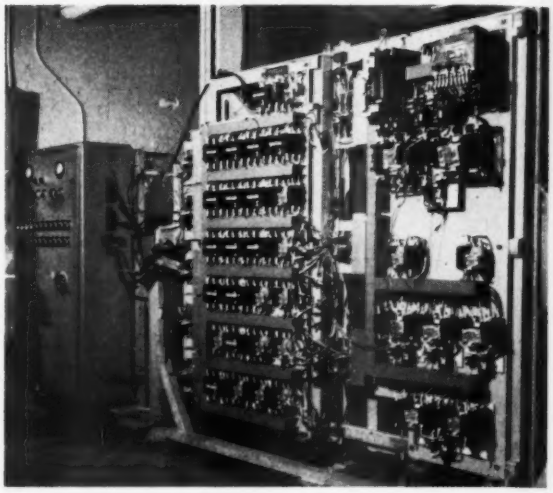


Fig. 1. Automatic machine electrical control panel testing device in use at The Warner & Swasey Co. Panel mounting rack (right) holds motor control and cycle control panels under test. Signal lights on test center cabinet (left) indicate any detected faults in individual panel circuits.

PANEL TESTER VERIFIES MACHINE WIRING CIRCUITS

TESTING ELECTRICAL CONTROL panel wiring, normally a time-consuming job for machinery builders, is being handled today at The Warner & Swasey Company, Cleveland, on a fast automatic basis using a special panel testing device designed by the company's own electrical engineers.

Formerly requiring about 5 hrs labor when done manually by an electrician using a continuity checker, machine cycle control and motor control panel wiring now is verified automatically by the new testing device in just slightly over 2 min. The device accurately simulates every electrical operating function of the actual machine during the test, quickly detecting any shorted or open control panel circuits. A display of easily-read signal lights visually indicates each detected fault.

The new testing device consists of three major elements: a rack on which the control panels to be tested are mounted; a motor-driven cam drum operating a series of electrical switches; and a test center cabinet incorporating operating controls and signal lights, plus auxiliary relays and starters which supplement the action of the cam-actuated electrical switches.

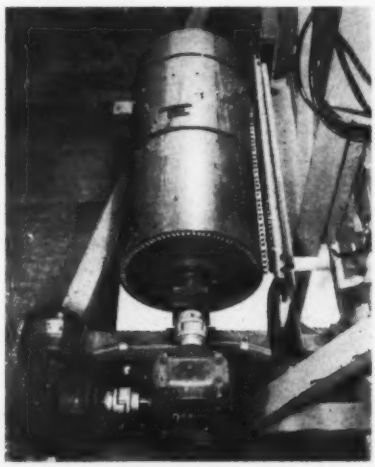
The panel mounting rack comprises a basic metal frame to which are attached various secondary frame units custom designed to accommodate each of the different control panels used with the numerous sizes and types of machines in the company's line.

Electrical connecting blocks operated by quick-acting clamps are attached to the secondary frames and are used to make the necessary electrical connections between the circuits of the testing device and the terminal blocks on the control panels.

Wiring from the terminal blocks to the test center cabinet is cabled, with multiple-contact connectors employed at the junction of the cabling with the test center circuits. In this manner, it is possible to change the wiring setup swiftly when converting from the testing to one type of machine control panel to another of completely different design.

The automatic testing device's cam drum is of hardwood construction and is driven through reduction gearing by a 1/6-hp electric motor started by a pushbutton mounted on the front of the test center cabinet. As the cam drum rotates, it actuates in sequence a series of some 40 electrical switches which set up relay circuits simulating actual operation of the machine.

Fig. 2. Panel testing device's rotating cam drum (viewed from overhead) is of hardwood construction and is driven through reduction gearing by a 1/6-hp electric motor. As the drum rotates, its cams actuate in sequence the series of electrical switches (to right of drum) which set up relay circuits simulating actual operation of the machine.



Key to the operation of the entire testing device is the cam drum drive motor wiring arrangement, which consists of two parallel power circuits. The first, initiated by the test center pushbutton, supplies power to the drive motor directly through a conventional motor starter unit. The second power circuit, in parallel with the first, is connected in series with the various panel circuits under test.

As each electrical switch is actuated by the rotating cam drum, the first, or direct, power circuit to the drive motor is opened, and the second circuit, actually the control panel circuit being tested, carries the load to the motor. If this control panel circuit is faulty, the drive motor immediately stops due to lack of electrical power, and a signal light is illuminated on the test center panel indicating which circuit is involved.

The electrician making the test uses a sequence sheet, prepared by the engineering department, which lists each of the control panel circuits in the exact order of test and also presents an elementary wiring diagram of each step in the checking procedure. Thus, the electrician can pinpoint any indicated faults in a minimum of time. The cam drum drive motor is restarted and the testing procedure continued following detection of a fault simply by pressing the motor "Start" button.

Not only has this automatic panel testing device solved a serious bottleneck in the production of machine tool electrical control panels, says Warner & Swasey, it also has made possible a considerable reduction in the number of final electrical operating adjustments required by new machines on the actual production floor.

end

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CIRCLE INFORM-A-GRAM KEY NO. 93

Vacuum Type Shaping Fixture Permits Accurate Skin Trimming

by Robert L. Starkey
Manufacturing Engineer
THE GLENN L. MARTIN COMPANY
Baltimore, Maryland

Fig. 1. Trimming an aluminum skin detail. The sides and ends of the fixture are properly angled to allow the fixture to lay flat, and also to permit the shaper blade to cut along parallel trim lines on all four sides with one adjustment of the blade.

SHAPING OF "Orange peel" type skin details is simplified with a new tool developed by Martin manufacturing and research engineers. Contoured aluminum skins up to .080" thick are vacuum locked to this new shaping fixture and accurately trimmed to provide precise butt fittings of the skins in the inertial nose of the USAF TM-61 Martin Matador Missile.

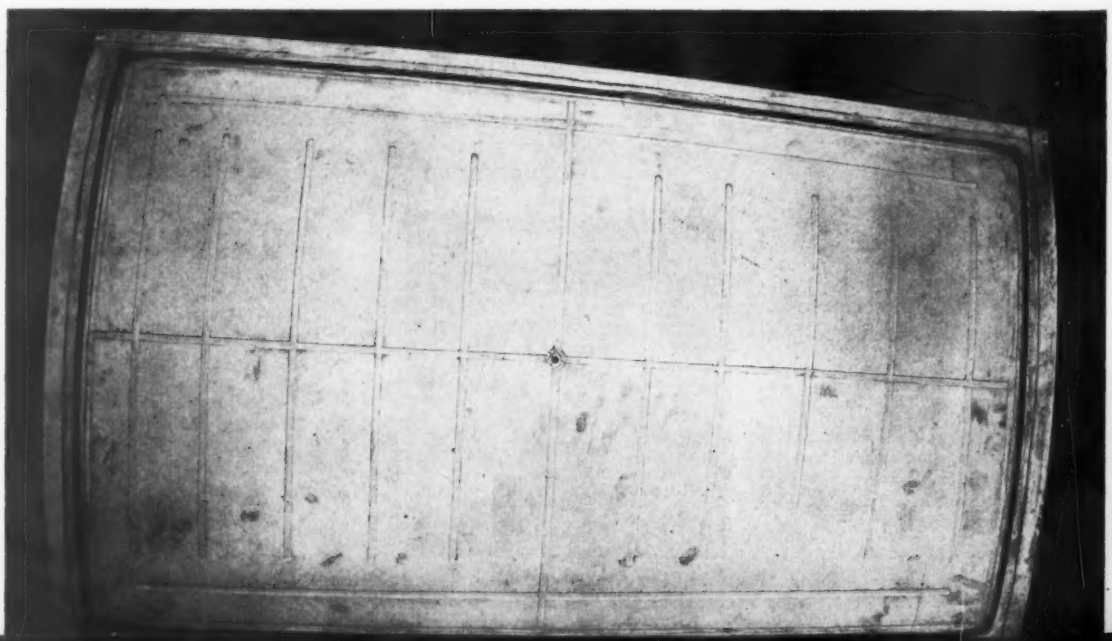
The 40-lb fixture is made of plastic fiberglass laminate, shaped from a plaster cast conforming to the Matador's nose skin contour. Aluminum skin details are placed on the fixture and aligned with tooling pins or positioning tabs located on the oversized edge of the detail. The skin is securely locked in position by creating a vacuum of 18 psi between the skin and a network of vacuum grooves with a ring of ¼" rubber tubing providing the seal. The pressure is applied and held constant by means of a Marvac venturi unit with a Hansen quick disconnect fitting, which prevents any twisting of the vacuum hose during the trimming operation.

The sides and ends of the shaping fixture are properly angled to lay flat on the shaper table, thereby permitting the shaper blade to cut along the straight trim lines with one adjustment of the blade.

The laminated plastic shaping fixture and the new trimming method eliminates the hand cutting and filing operations formerly required.

end

Fig. 2. A laminated plastic shaping fixture showing vacuum grooves and a seal ring of ¼" rubber tubing. Aluminum skins are vacuum locked to this fixture and trimmed along straight trim lines.



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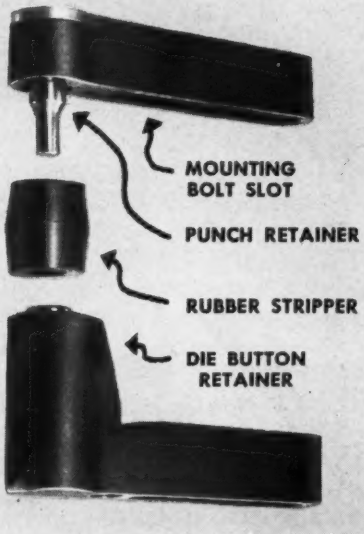
PUNCH & DIE BUTTON POSITIONING *Flexibility* with R-B *Flex-Mount* RETAINERS

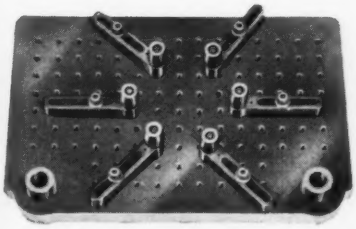


Cut your set-up time for short production runs on light gauge metals . . . R-B Flex-Mount Retainers permit quick, easy and flexible mounting of punches and die buttons. For, Flex-Mount Retainers are easily bolted in any desired position on T slotted or drilled and tapped commercial die sets.

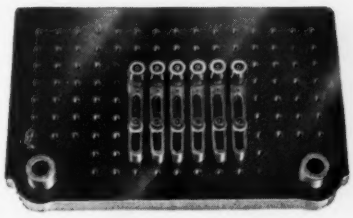
Standardized R-B punches and die buttons (round, square, oblong or special shapes to customer specifications) are used in these retainers. Stripping is accomplished with R-B rubber strippers or R-B rubber covered springs to eliminate costly metal strippers, retainer screws and springs.

Flex-Mount Retainers are available in many standard sizes.

TYPICAL *Flex-Mount* POSITIONING *Flexibility*



Shown are but two of an almost unlimited number of mounting arrangements that can be made with Flex-Mount Retainers.



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ROLL PLANISHING OF WELDS

• Removes Beads
• Improves Weld Quality

MANUFACTURING CONCERNS that use welded components are faced with four primary problems in respect to their welds: (1) How to achieve high tensile strength of the weld, without heat treating; (2) How to achieve a grain structure in the weld similar to the grain structure of the parent metal; (3) How to maintain ductility of the welded area; and (4) How to get away from the "notch effect" experienced in welding. The roll planishing of continuous welds offers tremendous strides in the solution of these problems.

There are several other possibilities for treating welds but none offer solutions to the above problems comparable to the fast and inexpensive cold working process of roll planishing.

Hammer planishing is much slower and requires more expensive equipment to produce usable welds, and the results are less satisfactory. Not only is the equipment more expensive, from the standpoint of the time involved for the operation, but the skill required is considerable.

Shearing is one way of getting rid of the welding bead, but it does nothing in the way of cold working the metal for the benefits thereof. Shearing equipment, too, has many limitations when it comes to contours.

Grinding has its place, but becomes prohibitive quickly as the size and length of the bead increase. Again, this method of removing a welding bead can do nothing for the grain structure of the metal.

Designing around problems is the business of the engineer, and, in instances where the ultimate strength of the bead, as is, will be sufficient and the bead doesn't offer an obstacle to further processing, it may be left in the design as is. The design engineer, however, is confronted with an ever-increasing demand for strong and lightweight products. Often it will be necessary to take advantage of every opportunity to gain in every direction. Unless the as-is weld obviously lends itself to the design of the end product, it is usually foolish for the engineers to spend much time in working around this weld projection. Planish it . . . and gain in many ways.

To gain the greatest benefits from roll planishing, a uniform weld is a prime requisite. Although skilled welders can attain surprising uniformity, more worthy welds can be had with greater speed, and at a nominal cost, if supplementary equipment is employed. Automatic welding equipment will pay for itself, quickly through its savings in labor and welding quality.

Photomicrographs show the gain in grain refinement and elongation from roll planishing. They also show the tendency toward residual stress relieving and the removal of "notch effect" (a drop-through of the weld metal).

Some shrinkage is experienced in welding. The benefits from roll planishing such as the planishing of cross welds and circumferential welds is entirely feasible.

Planishing machines are rated by tonnage delivered to the rolls, and are furnished to Industry in various sizes. The rolls are mounted at the open end of a "yoke" of the necessary throat depth to accommodate the pieces being rolled. Rolls are fabricated to suit the particular rolling condition, and the top one is driven for feeding the work through. The most popular size machine delivers 13,000 lbs at the rolls.

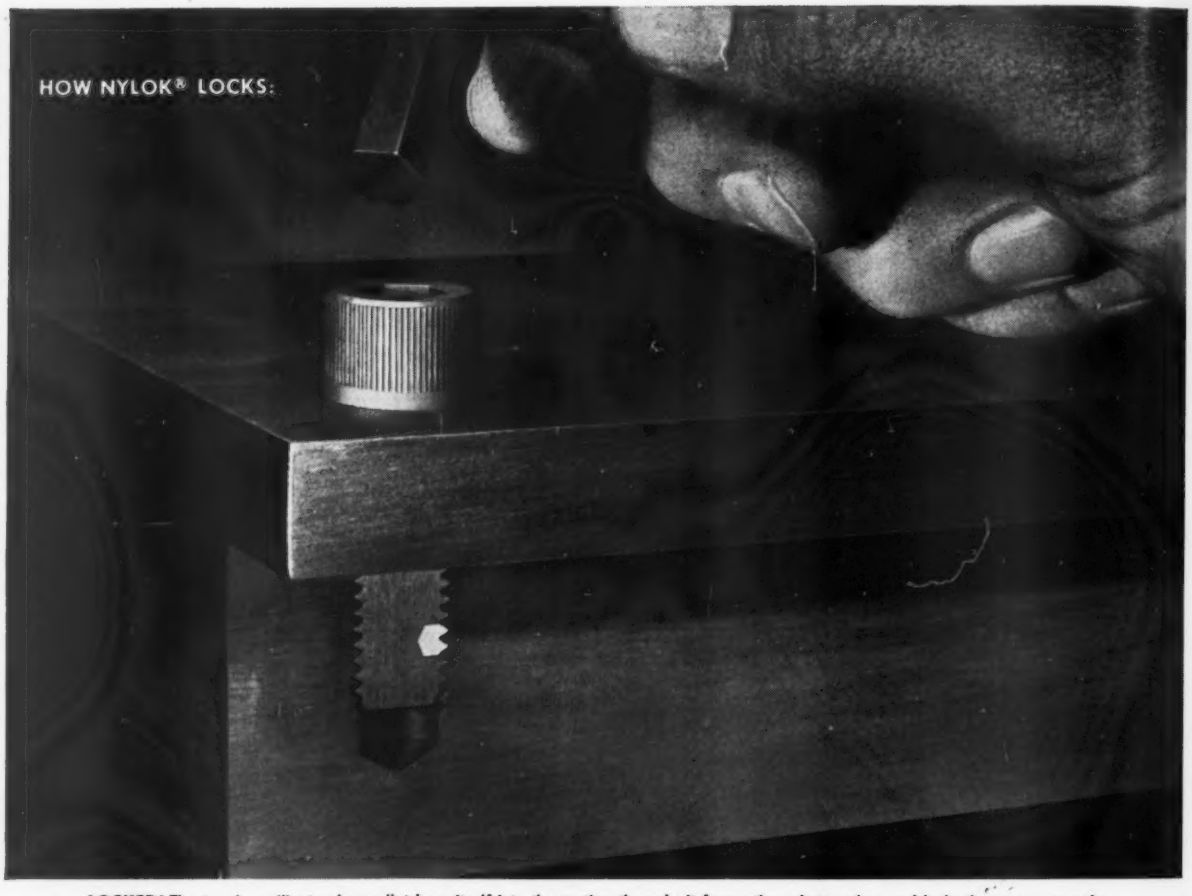
Probably the greatest boon from planishing is the economy of being able to heat treat before welding rather than risk cracking the weld by heat treating after welding. Depending on the processing of the product, the parts to be welded often can be purchased in the heat treated condition, welded and planished to end up with the desirable parent-metal to weld-metal relationship.

Companies such as Solar Aircraft have been roll planishing for the past eight years. They do a great deal of work welding titanium sheet, which is formed after welding to make jet combustion chambers.

In some cases where cones and similar shapes are welded, planished and then spun, the weld line is no longer discernable.

This little publicized process for the controlled cold working of welds was highlighted by B. R. Russell, President of the Airline Welding and Engineering Co., of Hawthorne, California, in an American Welding Society presentation at the recent National Metals Congress in Cleveland.

end



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

NEW—self-locking UNBRAKO socket head cap screws

Self-locking UNBRAKO socket head cap screw.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 36, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION

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JENKINTOWN PENNSYLVANIA

CIRCLE INFORM-A-GRAM KEY NO. 98

"Commendable Comments"

"We believe 1957 may be another year in which the automobile is dominant. But the point I want to make is this: The fate of the American economy and its underlying strength are not dependent upon conditions in any one industry or segment of our economy. While we cannot be complacent about any soft spots in our economy, neither can we afford to be stampeded into panic —for therein lies the gravest single threat to future progress."

—Ernest R. Breech, chairman of the board, Ford Motor Company, at a community ceremony saluting Ford-Reynolds in Sheffield, Alabama.

"Further expansion of our economy will mean more and more management jobs available. Despite a noticeable increase in the number and capabilities of managers, prospects for the future do not indicate that the increase will keep pace with economic expansion. We are facing the greatest shortage in management that this country has yet experienced."

—Lawrence A. Appley, president, American Management Association.

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EYE INJURIES IN METALWORKING

by W. Schweisheimer, M.D.

OF ALL EYE ACCIDENTS, 60% occur in the metal producing and the metal-products manufacturing industries.

Such was the conclusion from an analysis of nearly 60,000 eye accidents that occurred during one recent year in the seven states that reported accidents by industry to the National Bureau of Labor Statistics. The states reporting were Illinois, Kansas, Michigan, Missouri, Ohio, Tennessee, and Utah. In six of these seven states, the metalworking industries were responsible for the largest number of eye accidents.

More than 50% of eye accidents in Minnesota and Illinois were caused by flying particles set in motion by hand tools and machinery. The next most common causes were abrasive wheels, corrosives, electric flashes, and molten metal.

Prevention of the Eye Accidents

A large number of the eye injuries is preventable. A survey of the usual types of accidents and their prevention was conducted recently by Drs. D. A. Campbell, W. J. B. Riddell and A. S. MacNalty. According to it, the most frequent eye injuries in metal casting come from splashes of molten metal. They occur either while the metal is being carried from the cupola to the molding shop or during the process of pouring the metal into the mold. Strong goggles should be worn.

In forging there is much spurting of hot metal in the process of shingling. Masks are usually worn for protection. In the use of turning lathes and drilling machines, eyes are injured by flying pieces of metal, often hot. Goggles and fixed guards on lathes will afford protection. Chips of metal fly off with great force in press-fitting. Fitters' benches should have wire screens between them, which protect each fitter from his neighbor's chips, and safety goggles should be worn.

In grinding, glazing and fettling dust is the chief enemy, as Dr. Campbell and associates point out. Grindstones and abrasive wheels produce much dust. To diminish the risk from dust, the stone or wheel is covered as far as is practicable and its operation connected with an exhaust fan. But some dust always escapes; that's why goggles are necessary.

The flying material in smithing, boilermaking, riveting, and like operations is larger and heavier. Many of the most serious accidents arise from this source. Close-fitting glass goggles are often too hot, and it has been suggested that a large measure of protection could be secured by the use of goggles of close mesh wire gauze.

Riveters who often do their work in confined spaces with little support, and sometimes at a considerable height above the ground, need all their vision to ensure safety of limb and are reluctant to wear goggles or other devices for safety of eye.

Iron-Workers' Cataract

Iron workers' cataract is an eye disease peculiar to those who are exposed to the heat and glare of a furnace for many hours each week. A cataract consists in the loss of transparency of the lens of the eye. All light has to pass through the lens inside the eye and, if the lens become opaque, blindness results.

Iron-workers' cataract is of very slow onset; it usually does not happen until after 15 to 30 years of work. It seems to be caused by heat. Iron-smelters, forgemen, puddlers, steel mill workers, and chain-makers are typical of those workers who are exposed to glowing heat for many hours. Ultra-violet radiation may also be a cause of the disturbance of the lens.

When such cataracts have developed and are "ripe", operative removal of the opaque lens will restitute vision. However, it is better to prevent the occupational injury to the eye, and this is possible by the use of appropriate glasses.

Eye emergencies in industry have assumed a tremendous importance because of their number and their cost to management and labor. Between 300,000 and 400,000 industrial eye accidents necessitating absence from work of one day or more occur each year in the United States!

It is far better to prevent these accidents than to treat them. And if they do happen, as Dr. A. A. Knapp pointed out recently, proper first aid treatment by the attending physician will save millions of dollars and thousands of manhours and will in most instances prevent irreparable physical and mental injury.

Arc Flash of Welders

Arc flash, usually an eye inflammation (conjunctivitis), of both eyes is caused by excessive exposure to the welders' electric arc. It is characterized by delayed onset, duration of 24 hrs, red eyes, swelling of the lids, slight sunburn of the face, production of tears, intolerance of light and a feeling of sand in the eyes.

By proper care all signs disappear within 24 hrs in most cases, and almost certainly within 48 hrs. Eyes are protected from the infra-red ray of the arc flash by ferric oxide lenses which filter out most of the harmful radiations. It is not the welder who is the most frequent victim of his own arc, but the workmen engaged in work near him. The welder protects himself with a hood. Still he may receive a flash injury from another welder's arc, or from his own "accidentally struck" arc while his hood is raised. Minimal safe distance to a welder's arc without protection by goggles is estimated as 200'. See "Safe Practices in Welding", TOOLING & PRODUCTION, Jan. '56, p. 154.

Foreign Bodies in the Eyes

Most foreign bodies are superficially located in the eye. The eyelids close automatically when anything threatens the eye. If a foreign body — sand, dust, metal, splinter, etc. — lodges on the eyeball, an increased flow of tears often succeeds in washing it off. The foreign body is then removed at the corner of the eye.

If this is not successful, it may be possible to lift the foreign body off the eye with the clean corner of a handkerchief or a clean piece of blotting-paper. However, such action under non-sterile conditions should not be taken except as an emergency measure. The worst possible thing is to rub an irritated eye. In the first-aid room, the eye may be irrigated with a non-irritating solution and usually a magnifying glass is available to assist in removal of more persistent foreign bodies. The tears contain a disinfecting substance that will destroy a good many germs laying around in the eye.

No attempt should be made to rub a foreign body off the cornea — the transparent part of the eye through which is seen the pupil, the dark hole in the middle of the eye. If the foreign body does not come off on blotting paper, it is probably embedded in the cornea. Any rubbing will only implant it more deeply in the delicate cornea.

There are times when metallic foreign bodies can be removed with the help of a magnet—a highly satisfying operation if it succeeds. This should be attempted only by trained medical workers. But the great increase in the use of non-magnetic metals and alloys in industry has resulted in many foreign bodies being embedded in the eye that are incapable of removal with a magnet. If disturbances occur in such cases, surgical removal of the foreign body will be necessary. A small chip of metal from a hammer or chisel may strike the eye at a high velocity and all that may be seen is a minute track in the cornea. **A foreign body within the eyeball generally requires highly specialized care.**

A good many foremen in the metal industry are well trained in the proper kind of first aid for eye injuries, but is a practice to be discouraged in favor of trained specialists in industrial health and first aid. Improper attempts to remove a foreign body from the eye have sometimes seriously damaged the eyesight. It is a well-known fact that under normal conditions the eye surface heals with great speed.

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Just three Bliss High Production Presses produce the millions of motor laminations Black and Decker uses in its complete line of more than 150 portable power tools!

Running in the upper speed range, sometimes at well above 250 strokes per minute, through two shifts a day—and occasionally three. And they've been doing it for a long time now with no problems.

Of course, H-P presses are built for speed. Extra heavy cast Meehanite frame • *Square* gibbing • Automatic lubrication • Variable speed drive • Special air friction clutch • Counterbalanced crankshaft. Every feature has been especially designed to maintain precision at top speeds. That adds up to top production rates, longer die life.

Another plus, users tell us, is the wide open die area that makes quick set-up and changeover possible. In fact, the fast set-up makes *short-run* work practical with Bliss H-P Presses. And the room *under* the press is a handy place to run chutes or store tote boxes.

If production of short-stroke stamped parts is your problem, long run or short, you'll want to learn more about Bliss H-P presses. Our recently revised 32-page catalog No. 27-C describes the entire line and gives examples of the wide range of work you can accomplish with these presses. Why not write for a copy today.

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ROLL PLANISHING OF WELDS

- **Removes Beads**
- **Improves Weld Quality**

MANUFACTURING CONCERNS that use welded components are faced with four primary problems in respect to their welds: (1) How to achieve high tensile strength of the weld, without heat treating; (2) How to achieve a grain structure in the weld similar to the grain structure of the parent metal; (3) How to maintain ductility of the welded area; and (4) How to get away from the "notch effect" experienced in welding. The roll planishing of continuous welds offers tremendous strides in the solution of these problems.

There are several other possibilities for treating welds but none offer solutions to the above problems comparable to the fast and inexpensive cold working process of roll planishing.

Hammer planishing is much slower and requires more expensive equipment to produce usable welds, and the results are less satisfactory. Not only is the equipment more expensive, from the standpoint of the time involved for the operation, but the skill required is considerable.

Shearing is one way of getting rid of the welding bead, but it does nothing in the way of cold working the metal for the benefits thereof. Shearing equipment, too, has many limitations when it comes to contours.

Grinding has its place, but becomes prohibitive quickly as the size and length of the bead increase. Again, this method of removing a welding bead can do nothing for the grain structure of the metal.

Designing around problems is the business of the engineer, and, in instances where the ultimate strength of the bead, as is, will be sufficient and the bead doesn't offer an obstacle to further processing, it may be left in the design as is. The design engineer, however, is confronted with an ever-increasing demand for strong and lightweight products. Often it will be necessary to take advantage of every opportunity to gain in every direction. Unless the as-is weld obviously lends itself to the design of the end product, it is usually foolish for the engineers to spend much time in working around this weld projection. Planish it . . . and gain in many ways.

To gain the greatest benefits from roll planishing, a uniform weld is a prime requisite. Although skilled welders can attain surprising uniformity, more worthy welds can be had with greater speed, and at a nominal cost, if supplementary equipment is employed. Automatic welding equipment will pay for itself, quickly through its savings in labor and welding quality.

Photomicrographs show the gain in grain refinement and elongation from roll planishing. They also show the tendency toward residual stress relieving and the removal of "notch effect" (a drop-through of the weld metal).

Some shrinkage is experienced in welding. The benefits from roll planishing such as the planishing of cross welds and circumferential welds is entirely feasible.

Planishing machines are rated by tonnage delivered to the rolls, and are furnished to Industry in various sizes. The rolls are mounted at the open end of a "yoke" of the necessary throat depth to accommodate the pieces being rolled. Rolls are fabricated to suit the particular rolling condition, and the top one is driven for feeding the work through. The most popular size machine delivers 13,000 lbs at the rolls.

Probably the greatest boon from planishing is the economy of being able to heat treat before welding rather than risk cracking the weld by heat treating after welding. Depending on the processing of the product, the parts to be welded often can be purchased in the heat treated condition, welded and planished to end up with the desirable parent-metal to weld-metal relationship.

Companies such as Solar Aircraft have been roll planishing for the past eight years. They do a great deal of work welding titanium sheet, which is formed after welding to make jet combustion chambers.

In some cases where cones and similar shapes are welded, planished and then spun, the weld line is no longer discernable.

This little publicized process for the controlled cold working of welds was highlighted by B. R. Russell, President of the Airline Welding and Engineering Co., of Hawthorne, California, in an American Welding Society presentation at the recent National Metals Congress in Cleveland.

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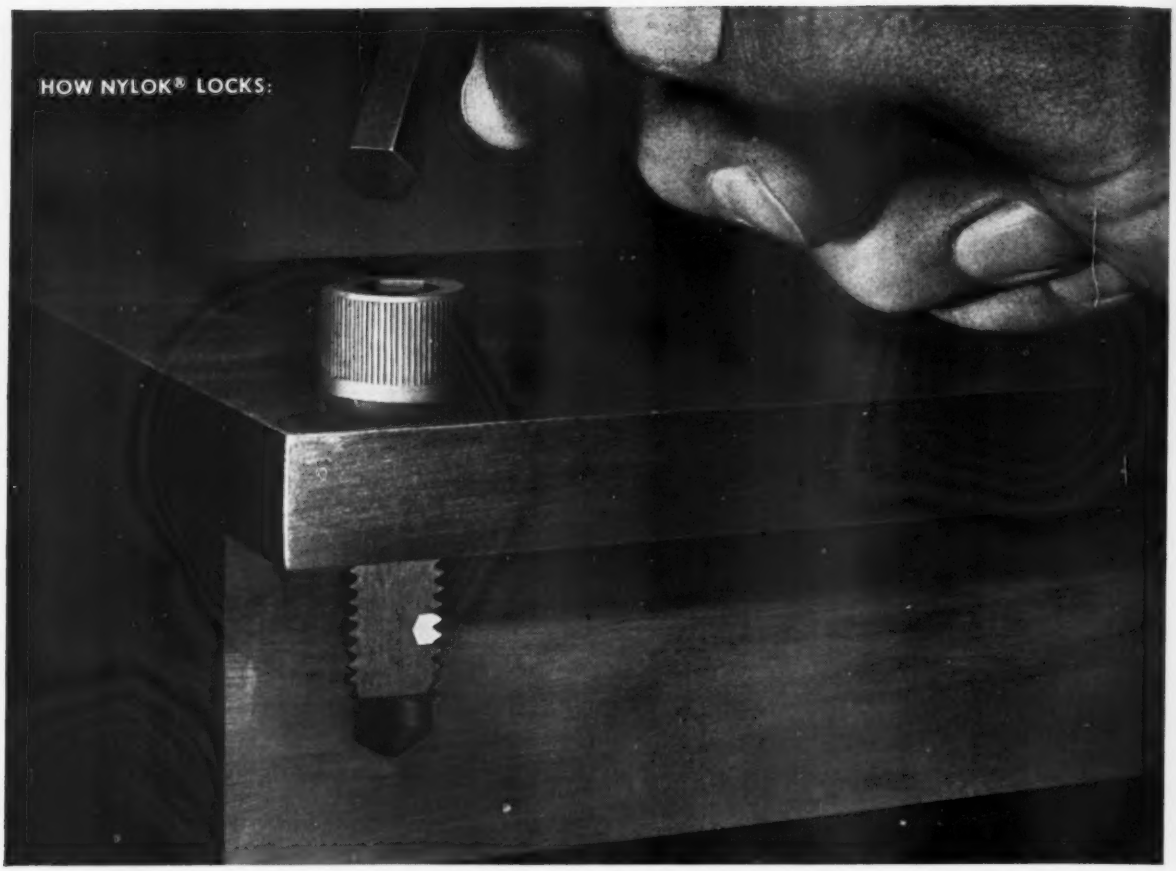

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NEW—self-locking UNBRAKO socket head cap screws

Self-locking UNBRAKO socket head cap screw.

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UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

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by W. Schweisheimer, M.D.

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E. W. BLISS COMPANY, CANTON, OHIO • Presses, Rolling Mills, Rolls, Special Machinery

CIRCLE INFORM-A-GRAM KEY NO. 101

WHY MONARCH lathe head stocks are MICROHONED

Monarch Machine Tool Company Microhones the spindle bores in its lathe head stocks because Microhoning . . . generates consistent finish, size, and alignment of bores . . . corrects out-of-roundness . . . eliminates cost of line-reaming operations . . . permits interchangeability of spindles and bearings.

And with the use of a new three-diameter Microhoning tool, honing time is reduced approximately 40% over former method which employed two double-diameter tools. One set-up now replaces multiple set-ups previously required.

APPLICATION DATA:

STOCK REMOVAL
.003″ to .004″

TOLERANCES
diameter..... .0002″
roundness..... .0001″
taper..... .0001″

FINISH....20-25 microinches

PREVIOUS OPERATION
line boring

3 IN-LINE BORE SIZES
4.125″ dia. x 1.500″ long
5.118″ dia. x 1.250″ long
6.299″ dia. x 5.125″ long

Micromatic tooling for Microhoning applications is constantly furnishing manufacturers with cost reductions, higher production and better functional characteristics. A Micromatic Field Engineer will be glad to discuss your production problems and show you "Why" the proper Microhoning tools will help.

The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on_____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME_____
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COMPANY_____
STREET_____
CITY_____ZONE____STATE_____ C

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 102

People Are Important

by Erwin K. Taylor, Ph. D.
President
PERSONNEL RESEARCH AND DEVELOPMENT CORP.
Cleveland 20, Ohio

How Many Men?

"ARE THE GRINDING department workers getting enough supervision?"

"Can we add three men to the pickling department without appointing another foreman?"

"Should we give the heat-treat foreman a clerical assistant so that he will have more time to be out on the floor?"

"Couldn't we do just as well without an assistant foreman in the drill-press department?"

How many times in the course of a year have you asked and tried to find the **right** answer to questions like those above? The problem of determining the best work load for first line supervisors is one that has probably troubled everybody in production management at one time or another. And each plant manager, department superintendent and general foreman who has wrestled with it has probably felt, at one time or another, that everyone else had the answer. This, of course, is not the case.

There is no **one** right answer, since the job of the first line supervisor varies so widely, not only from industry to industry and from plant to plant, but even within plants in the same organization. For example, in one of the giant manufacturing organizations, management found that some foremen were supervising about five times as many men as other foremen in identical jobs, in other plants. To determine the whys and wherefores of this situation, they have turned the problem over to one of their industrial psychologists who has begun to collect the data on which to base an analysis.

But, it is not only the largest organizations which are concerned with the supervisory load. Dr. Robert M. Guion enlisted the aid of 98 manufacturers who gave information on 940 first-line supervisors, their jobs and their work loads. His study does not answer the question "How many people **should** a foreman supervise?" It merely reports current practices and the factors which determine the number of men super-

vised. He worked out a simple formula by which it is possible to compute the average number of employees supervised based on certain characteristics of the job situation, such as the nature of the jobs, plant size and amount of supervisory assistance. Using this formula you can compare the average supervisory load of persons who are in jobs similar to those of your own foremen.

How can you compare your plant with Dr. Guion's study?

By classifying any foreman on the basis of the characteristics described below it is possible to get a fairly accurate estimate of how many men the average foreman supervises.

To make this determination start with the number 29. That's the overall average number of workers supervised for all the supervisors in the study. Then locate the foreman's position with respect to each of the 11 factors in the table below. Add or subtract the given number for each classification.

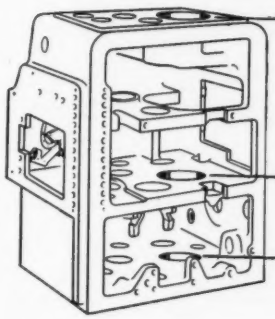
Factor	Code	Adjustment
A. Nature of Jobs Supervised		
Individual work	A-1	+1
Gang work	A-2	—4
Gang work, more than one gang	A-3	+2
Process production, worker paced	A-4	+1
Process production, machine or process paced	A-5	—5
More than one of the above	A-6	—6
B. Method of Paying Employees		
Straight hourly	B-1	—2
Straight Salary	B-2	—5
Individual group incentive or combination	B-3	+3
C. Classification of Supervisor's Department		
Production	C-1	+2
Other than production	C-2	—4
D. Size of Plant		
Less than 600 employees	D-1	—1
601-1000 employees	D-2	+5
1001 or more	D-3	—2
E. Manufacturing Classification		
Other than chemical	E-1	+1
Chemical process manufacturing	E-2	—4
F. Amount of Floor Space		
Less than 2000 Square Feet	F-1	—9
2001—10,000 Square Feet	F-2	—3
Over 10,000 Square Feet	F-3	+4
G. Average Learning Period of Jobs Supervised		
Less than 30 days	G-1	—1
One to six months	G-2	+3
More than 6 months	G-3	—2
H. Amount of Supervisory Assistance		
Less than 39 man hours	H-2	—8
40-49 man hours	H-3	0
50-119 man hours	H-4	+4
120 or more man hours	H-5	+25
I. Amount of Clerical Assistance		
9 Man hours or less	I-1	—1
10 to 40 man hours Inclusive	I-2	+1
More than 40 man hours	I-3	+7
J. Number of different kinds of jobs supervised		
One or two kinds	J-1	—5
Three or four kinds	J-2	—3
Five, six or seven kinds	J-3	+1
Eight or more kinds	J-4	+8
K. Proportion of time spent "off the floor"		
Less than 8%	K-1	—2
8% or more	K-2	+1

After you have added and subtracted the eleven "adjustment numbers" to the 29 that you started with, you will get a result between 90 and minus 19. Obviously a foreman cannot have a negative number of workers. A second table is needed to correct estimates of less than 15 or more than 61. Space does not permit its publication here. But it may be found in **Personnel Psycholo-**

HOW with one set-up MONARCH MICROHONES three bore diameters

Using a three-diameter tool and only one set-up, Monarch Machine Tool Company Microhones three in-line bores in lathe head stocks. Bore diameters are 4.125", 5.118" and 6.299". Stroke of Microhoning tool is changed only once during the working of all three bores. Former method of honing required multiple tooling and set-up.

How Monarch Microhones:



BORE "C"
6.299" Dia. x 5.125" Long

BORE "B"
5.118" Dia. x 1.250" Long

BORE "A"
4.125" Dia. x 1.50" Long

FIRST STROKE SETTING | Bore "A" is Microhoned while guiding on Bore "B"
Bore "B" is Microhoned while guiding on Bore "A"

SECOND STROKE SETTING | Bore "C" is Microhoned while guiding on Bore "B"

How This Microhone Tool Operates:

A compound cone in the tool allows any one of the three bores to be Microhoned by expanding or collapsing individual banks of stones and guides. A selector sleeve shifts the cone rod to provide positive control of abrasives and guides.

Micromatic "How" knowledge, obtained through 27 years of experience in designing, engineering and manufacturing of Microhoning equipment for all types of applications throughout the world, can solve your production honing problems.

Learn how Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____
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MICROMATIC HONE CORP.
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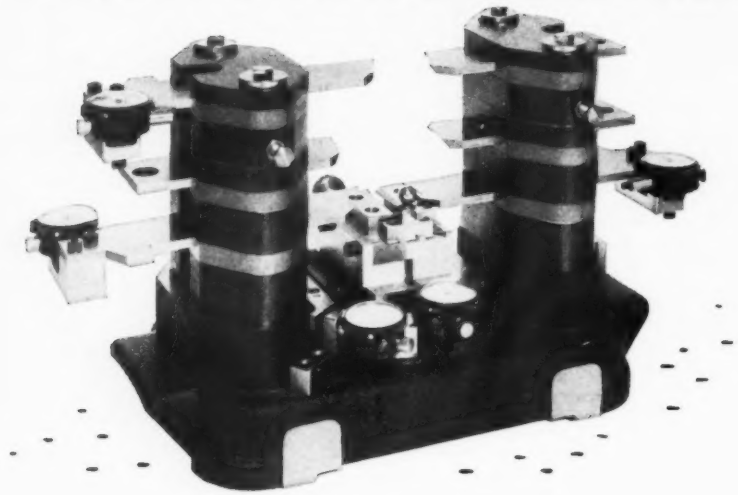
CIRCLE INFORM-A-GRAM KEY NO. 103

Darwin OIL HARDENING

FLAT GROUND STOCK



CHECKS
JET ENGINE
*BLADES to ± .0005"

Shown is the Winslow Mfg. Company's Standard Guillotine Gauge on which most aircraft manufacturers and their suppliers check the accuracy of the airfoil on Jet Engine blades. Winslow uses Darwin & Milner flat ground stock for the templates which are pressed against the blades at several critical points. Winslow buys Darwin & Milner because of its superior finish, close dimensional tolerance and uniform hardness. If you require flat ground stock of this quality in any one of a 1001 sizes—call on Darwin & Milner, or write for full information—NOW!

*These tolerances are often exceeded when the accuracy of the gauges are finally passed by Winslow.

Complete line of highest grade Tool Steels, including PRK-33, DARWIN No. 1, NEOR, MINEOR, OHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in Bar Stock, Billet and Sand Casting, Drill Rod, Flat Ground Stock and Tool Bits. Bulletin on Request.

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• 1610 W. FIRST AVENUE • COLUMBUS, OHIO •
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CHARLES B. WEBSTER, PLAINVILLE, CONNECTICUT • CHARLES W. BRINGMAN, ORLANDO, FLORIDA

CIRCLE INFORM-A-GRAM KEY NO. 104

gy, Volume 6, No. 2, Summer 1953, where Dr. Guion's original article appears.

If you suspect that some of your foremen are overloaded or underloaded, you may find it interesting to see how they stack up against the average.

Differences of as much as twenty-five percent overload or underload may very well be a function of local circumstances, but should the deviation from the average exceed this amount to any extent, the situation would bear looking into.

This one experiment will by no means solve the supervisory load problem, but it does provide a handle to get started with. It in effect extends each manager's experience one hundred fold. It is another illustration of the many ways in which the industrial psychologist can provide management with tools to help them solve their people problems.

Editor's Note:
If you want a copy of the second table referred to by Dr. Taylor, just drop him a line in care of Tooling & Production.

Will You Be There?

Dec. 6-7. Cost Control Conference. Metallurgical and Chemical Engineering Building, Illinois Institute of Technology, Chicago.

•

Dec. 6-7. Armour Research Foundation. Modern Builders' Conference. Chicago.

•

Jan. 16-18. Society of Plastic Engineers, Inc. 13th National Technical Conference. Sheraton-Jefferson Hotel, St. Louis, Mo.

•

Jan. 21-25. American Standards Association. Gaillard Seminar on Industrial Standardization. Engineering Societies Building, New York City.

•

Jan. 21-31. Engineering and management course. University of California, Los Angeles.

•

Jan. 28-31. Eighth National Plant Maintenance & Engineering Conference. Public Auditorium, Cleveland.

•

Jan. 30-31. Armour Research Foundation and Chicago Chapter of American Welding Society. Third Annual Midwest Welding Conference. Chicago.

•

Jan. 30-31. American Society for Engineering Education. Ninth Annual College-Industry Conference. University of California, Los Angeles.

THE FRINGECOUNT* MICROMETER

DIRECT MEASUREMENT TO 0.000001"

SIMPLE TO OPERATE...DIGITAL READING

The new FRINGECOUNT micrometer brings laboratory precision with increased speed to your inspection and quality control departments.

This new precision instrument is particularly suited to the measurement of gage blocks, plug gages, other external standards as well as close tolerance production parts.

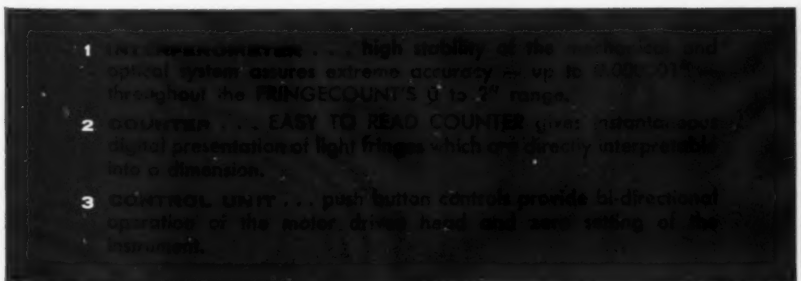
The most stable measuring standard known – the wavelength of light – is the gage put to use in the FRINGECOUNT micrometer. It combines the interferometric principle with an electronic system which counts light fringes – projects them into a digital counter for fast interpretation into a dimension.

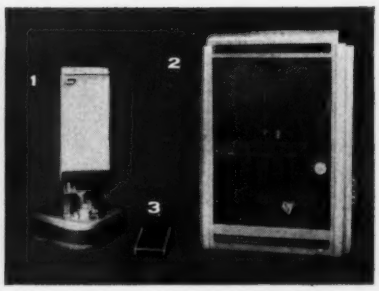
Operation is simple – just *two* push-button controls. Other FRINGECOUNT advantages:

- Eliminates need for expensive master blocks.
- Measures flat or round parts equally well, equally fast.
- Adapts to many special measuring situations through the use of different anvils and spindles.
- Requires no calibration. As stable as the light source.

Find out how the FRINGECOUNT can be used in your operation; Write us today, Department TP for Bulletin LP-3521.

*Trade Mark of Link Aviation.





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CIRCLE INFORM-A-GRAM KEY NO. 105

Now! Closer gage block tolerances give you up to 75% longer wear life at no increase in price!

Ellstrom Standards are now produced and unconditionally guaranteed to specified millionths well within the following improved gage block tolerances:

"W" Working Accuracy Blocks: +.000008", −.000002" per inch of length, with flatness and parallelism held within .000006".

"I" Inspection Accuracy Blocks: +.000004", −.000002" per inch of length, with flatness and parallelism held within .000004".

In addition to providing finer accuracy at no increase in price, these Ellstrom Standards also give you up to 75% longer wear life. For, by reducing the allowable "minus" deviation, you get an additional guaranteed wear allowance of from 2 to 6 millionths of an inch, as compared to common industry standards, before the blocks need be considered worn undersize.

Ellstrom Standards are furnished in 28 basic sets of from 8 to 92 blocks in both rectangular and square styles. Individual blocks are also available in sizes ranging from .010" to and including 20.000" to meet your particular needs. Send for complete specifications and prices today!

Set No. 35-R: "W"—$195.00; "I"—$280.50

Set No. 81-SA: "W"—$545.00; "I"—$764.35

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DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
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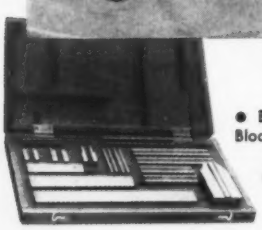
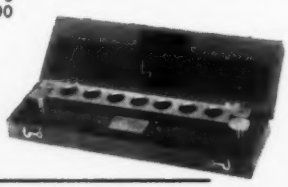


- Ellstrom Internal Setting Gage—12" range: $185.00
- Ellstrom Rectangular Gage Block Accessory Set: $288.95
- Ellstrom Master Sine Bar "W" Accuracy: $112.50 "I" Accuracy: $152.75



CIRCLE INFORM-A-GRAM KEY NO. 106

GROWING PAINS

Cadillac Stamp Company recently expanded its plant area. This addition houses the Machine Tool Division, which is designing, engineering and building specially required automatic and automated equipment.

◆

The Valve Division of **Minneapolis-Honeywell Regulator Company** has started construction on a three-acre manufacturing plant and home office at Fort Washington, Pa. The 120,000-sq-ft building, representing an investment of more than $1½ million, will house the entire manufacturing, sales, research, development and administrative facilities of the division, now located in Philadelphia. Production is scheduled to begin next summer.

◆

Construction of a new 60,000-sq-ft plant for **General Machine Products Company** in Bensalem (Pa.) township is now underway. The plant will be devoted to the manufacture of special machinery for the electrical, electronic and communication industries, and precision industrial components. It has been developed as a one-floor machine layout to expedite work flow and eliminate excessive materials handling.

◆

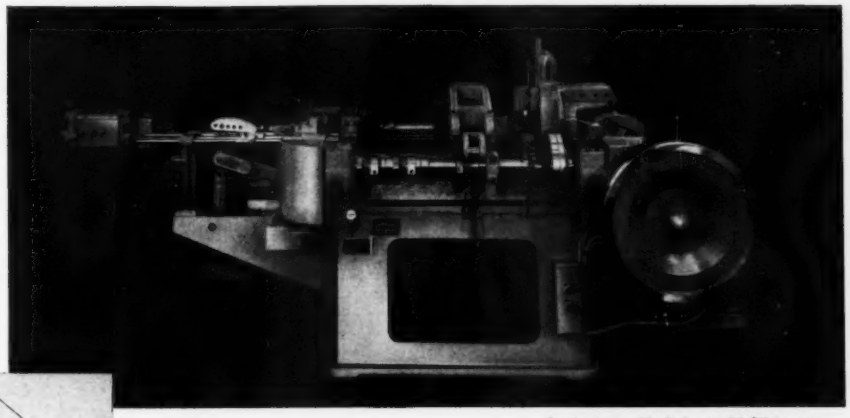
Detroit Broach & Machine Company is building a 15,000-sq-ft addition to its plant in Rochester, Mich. Although the present plant was completed in 1954, the company's current volume in broaching machines and tooling necessitated additional expansion.

◆

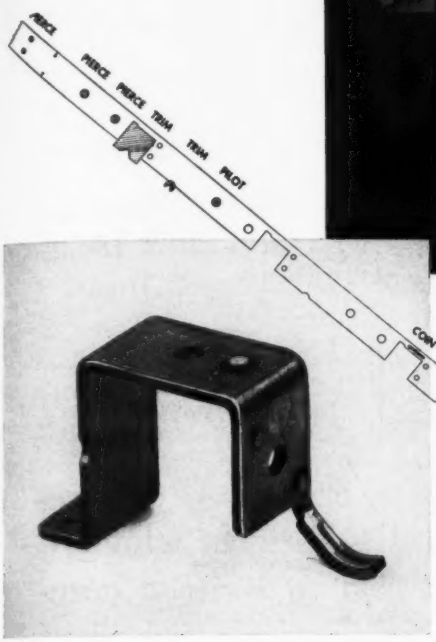
The Brandes Press Company is planning to build a new plant in Lake City, Pa., near Erie, for manufacturing its complete line of automatic stamping presses. The plant, located on a 37-acre plot of ground, will employ between 200 and 300 workers. Presses to be manufactured in the new plant will weigh up to 500,000 lbs.

◆

A new manufacturing plant and office building is being built in Mount Prospect, Ill., by **Charles Bruning Company, Inc.** at an estimated cost of $3 million. The plant, with a total of 307,100 sq ft of space, will be one of the world's largest plants devoted to the manufacture of diazotype reproduction machines and sensitized papers. The structure will more than double the size of the company's two separate Chicago plants, which it will replace.



Basic No. 33 U.S. Multi-Slide Machine used to produce (with appropriate tooling) the automotive component illustrated.



The drawing at the left shows the sequence of operations performed in the U.S. Multi-Slide to produce an automotive component complete in the U.S. Multi-Slide.

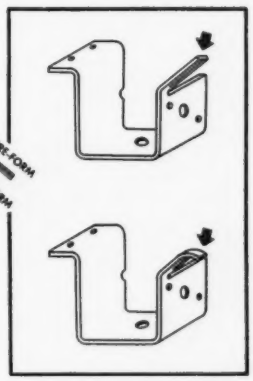
View of the completed part.

MULTIPLE OPERATIONS ON U. S. MULTI-SLIDES® MULTIPLY PROFITS

Each secondary operation eliminated means reduced piece part costs. You, like all other manufacturers, are striving to attain this end result. In the production of formed metal stampings from coil stock, the U.S. Multi-Slide may be the answer.

U.S. Multi-Slides are designed primarily for the automatic production of precision formed stampings from coil stock. Many different types of stampings ordinarily requiring secondary handlings can be produced complete on the Multi-Slide.

The part illustrated on these pages is a component for an automotive manufacturer and is produced complete without secondary handlings. The sequence of operations is pierce, trim, coin, extrude, cut off and form (2 levels). This automotive component is just one of many different types of stampings which can be produced complete on the U.S. Multi-Slide.



A two level forming position is used to produce the automotive component. The top view shows the pre-form obtained in the upper level and the lower view shows the finished form obtained in the second or lower level forming position.

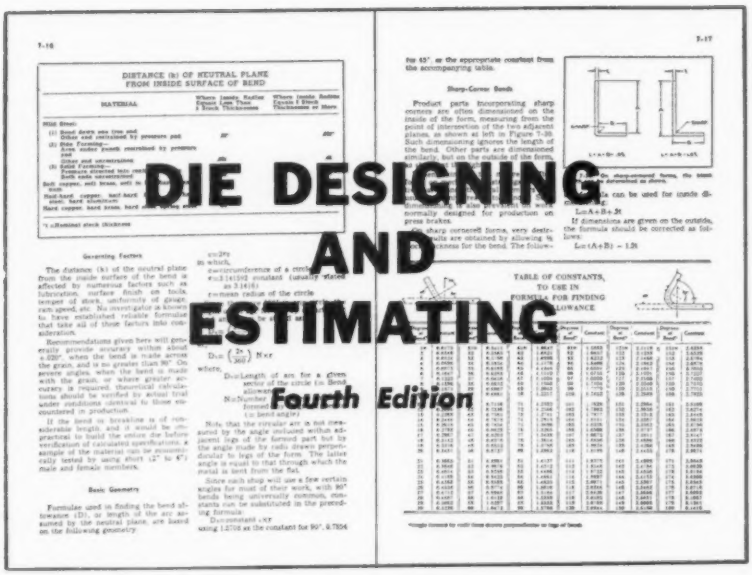
If stampings are included in your production program, ask for a copy of Bulletin 15-P illustrating and describing the four sizes of U. S. Multi-Slides we now build.

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange)
NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers
U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

CIRCLE INFORM-A-GRAM KEY NO. 107



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HYOP 54

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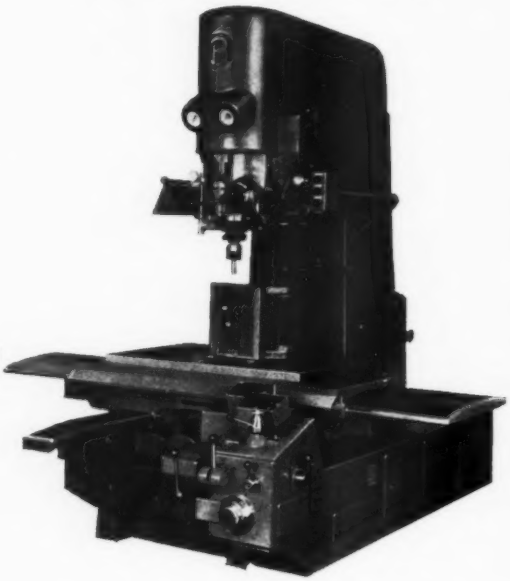
Hydraulically Operated

with LEITZ OPTICS and large projection screens

Accuracy of Adjustment Fifty Millionths of an Inch



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- Finish-milling
- Grinding
- Honing

- **Hydraulical movement of the table and the boring-slide.** Infinitely variable hydraulical feeds. Automatic reciprocal stroke of the boring-slide for grinding and honing.
- **Projection-optic system Leitz.** Pre-selection of positions up to .00005" accuracy.
- **Infinitely variable spindle-speeds by drive system Ward-Leonard.** Tool-feed by hydraulical movement of the boring-slide.
- **Drive of the grinding-spindle by medium-frequency-motor (manufacture Bosch).**

PARTIAL SPECIFICATIONS

Clamping surface of table	48" x 31"
Maximum distance between table and spindle	38"
Maximum quill travel (hydraulic)	10"
Grinding diameter (internal)	3/8" to 6 3/8"
Spindle speeds, infinitely variable	from 5 to 1,500 r.p.m.
Table movement, longitudinal	45"
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Power consumption of motor	8 H.P.

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CIRCLE INFORM-A-GRAM KEY NO. 110

MANAGEMENT AND TAXES, Special Report No. 10. Published by the American Management Association, 1515 Broadway, New York 36, N. Y., 1956. 127 pages, $3.75 (AMA members, $2.50).

Although management may depend on experts for answers to specific tax problems, company executives should have a basic understanding of how tax laws may affect planning and operation in their specific areas. This AMA report describes how typical companies have organized their tax departments, how these groups are administered and what bearing their work has on management decisions. In non-technical language, tax specialists show other executives how to identify tax-loaded situations in their areas of responsibility and how decisions in all departments interact to produce favorable or unfavorable tax situations.

It is not designed to make tax experts out of general executives but does show what to look for, how to recognize trouble spots in advance. It includes discussions of tax problems in purchasing, sales management and employment compensation, and also a report by Congressman Thomas B. Curtis on "a federal tax policy for economic wealth and security" as well as a valuable appendix on current patterns in tax administration.

METALLURGY, Fourth Edition, by Carl G. Johnson and William R. Weeks. Published by American Technical Society, 848 E. 58 St., Chicago 37, Ill., 1956. 454 pages, $5.50.

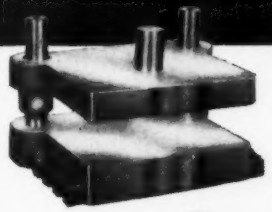
Here is a practical survey of metallurgy that stresses the importance of the physical and chemical properties of metals during shaping, sizing, fabricating and treating operations.

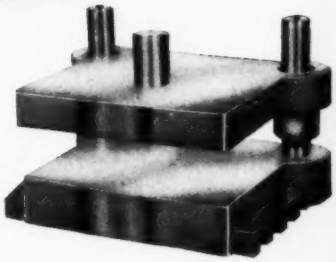
An entirely new chapter is included on the more recently developed metals: titanium, zirconium, indium and vanadium. Methods of production, physical and mechanical properties and uses of these metals are treated. New information on bearing alloys, aluminum alloys, alloy steels, copper and copper alloys, cast iron and heat treatment is also included.

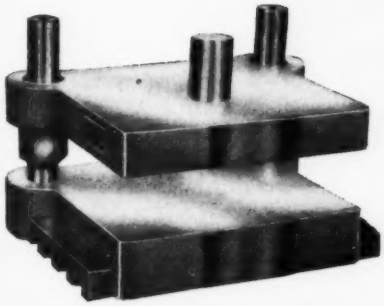
Over 100 photomicrographs in the book simplify the study of the structure of metals, and the equipment and methods used for making microscopic examinations are explained.

A Limitless Range of Die Set Sizes Jig-Bored to *YOUR* Specifications

SUPERIOR HAS THEM ALL







No Premium Price

No limitations to so-called "standard sizes" — result no waste — when you use Superior Die Sets. Superior sets are all *individually jig-bored to your specifications.* Result — the number of sizes you can get is almost limitless — you save on excess steel, needless machining, unnecessary weight and handling. Best of all, Superior Die Sets are priced competitively in all given sizes, so you save money in original cost by ordering only the exact size you need.

Check the many other exclusive features of Superior Die Sets and you'll see why they lead the field. Write for catalog and full information.

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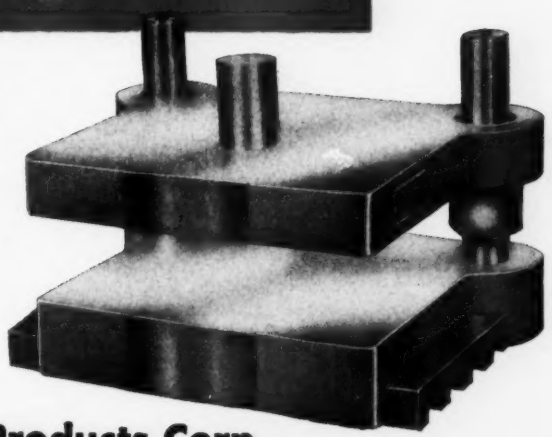

SUPERIOR **Steel Products Corp.**

2754 So. 19th Street, Milwaukee, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 111

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Presenting . . . Representing . . .

Besly-Welles Corp., South Beloit, Ill., has appointed Libb Tool Co., Inc. of Hartford, Conn., as stocking distributor for the complete line of Besly cutting tools and gages.

Ross-Willoughby Co. of Columbus, Ohio, has been named by Horton Chuck Division of Greenfield Tap & Die Corp., Windsor Locks, Conn., as Horton distributor in the Columbus, Ohio, area.

United States Gauge Division of American Machine and Metals, Inc., Sellersville, Pa., has disclosed the appointment of M. S. Jacobs & Associates, Inc., Pittsburgh, Pa., as a U. S. Gauge Master distributor. In addition, M. S. Jacobs will also serve as distributor for the complete USG Gotham line of indicating, measuring, recording and controlling instruments.

The new stocking industrial distributor for the Supreme line of industrial geared chucks, Push-Pull tapping attachments for power drills and the Versamatic reversible speed reducer for power drills is Columbia Machinery & Supply Co., of Pittsburgh, Pa.

Empire Tool Co. of Detroit, is serving as national distributor for Smitco Inc., manufacturer of Smitco shaving and skiving tools.

Edward V. Schuerer has become district representative in Wisconsin and the upper peninsula of Michigan for Torit Mfg. Co. He is responsible for the sales and service of the company's unitized dust collection equipment.

The appointment of two new representatives has been announced by Grant Pulley & Hardware Corp. Robert L. Sears is serving as a Grant representative in New York and Gerald Elton Duke, in the Pacific northwest.

Fred D. Ullman of the F. D. Ullman Co., manufacturers' representatives of San Francisco, has been appointed to represent Stanat Mfg. Co., Inc. The firm designs and builds rolling mills, gang slitters, roller levelers, wire flattening mills and related metal processing equipment. Mr. Ullman's assignment includes northern California, Oregon, Washington, Idaho, Utah, Arizona and western Montana.

Complete stocks of the products manufactured by Boyar-Schultz Corp. are being maintained by Elmer W. Pfeil, Inc., Cleveland, Ohio.

NEW YORK

"An irregular-shaped hole being ground to within .0002" on the No. 2 Moore Jig Grinder. The machine can do contour grinding of almost any size and shape."—*from facilities booklet of August W. Holmberg & Co., Inc., Flushing, N. Y.*

MISSOURI

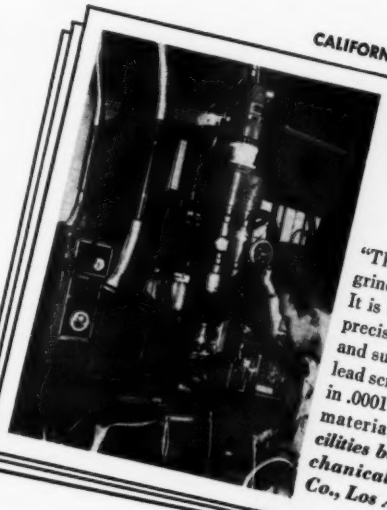
"Two No. 2 Moore Jig Borers...permit Ehrhardt to locate and bore holes accurately and to inspect the finished work."—*from facilities booklet of Ehrhardt Tool and Machine Co., St. Louis, Missouri.*

"FACILITIES, FACILITIES, FACILITIES..."

How Leading Tool and Die Shops Across the Nation Feature MOORE Jig Borers and Jig Grinders

Today, top contract tool and die shops often rely on illustrated booklets to sell prospects on their facilities. And they often rely on pictures of their Moore Jig Borers and Jig Grinders to indicate the degree of precision work they can do. It's particularly significant that leading contract shops choose Moore machines for "double duty"—in the toolroom and on the printed page—for these owner-managed firms are understandably deliberate and judicious in selecting machine tools. Write today for detailed bulletins on Moore's top-billed toolroom teammates.

CALIFORNIA



"This precision jig grinder is a Moore No. 2. It is used for producing precision holes, contours and surfaces to accurate lead screw settings within .0001" in heat-treated materials."—*from facilities booklet of Mechanical Specialties Co., Los Angeles, Cal.*

MOORE SPECIAL TOOL COMPANY, INC.
726 Union Avenue, Bridgeport 7, Connecticut

HOLES, CONTOURS AND SURFACES
Moore's *all-new* book tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. $5 in U.S.A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 113

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Fourth edition. 368 pages, 26 chapters, and over 400 illustrations, drawings, charts and graphs. Extensively revised and enlarged plus a special section of 165 Practical Points in Die Design and Construction. Completely indexed.
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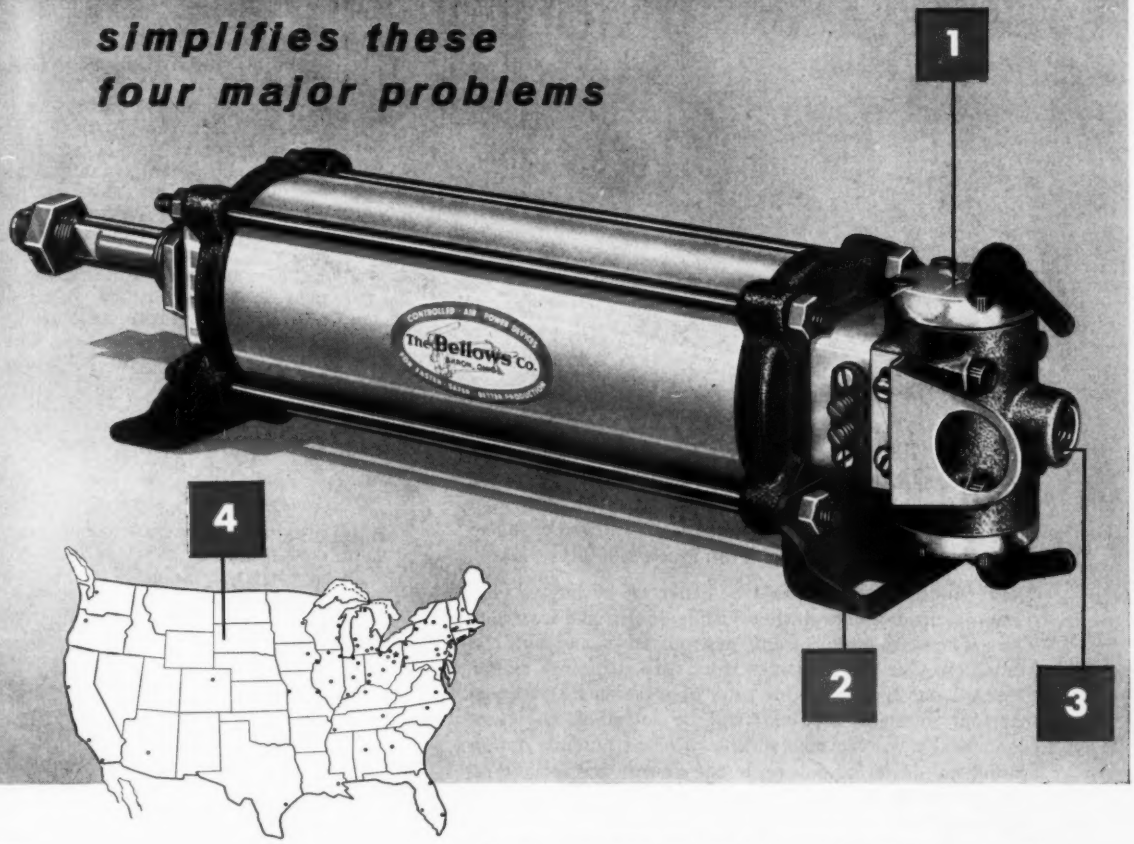
THE Bellows AIR MOTOR

simplifies these four major problems



1 **Built-in electrically controlled directional valve, either 8 or 110 v., simplifies design problems.**

2 **Built-in speed controls for accurate regulation of piston rod speed simplify control problems.**

3 **The single air connection, which can be made with flexible air hose, simplifies installation problems.**

4 **More than 125 Bellows Field Engineers in the United States and Canada simplify service problems.**

Design, control, installation and service are problems every O.E.M. Design Engineer faces when selecting components for automation.

In pneumatic design, the Bellows Air Motor—the air cylinder with the built-in valve—simplifies his problems. Instead of separate valving for directional control, separate valving for speed control, multiple mounting, complex and cumbersome piping for air supply—he works with one compact, complete power unit.

Not only are design and control simplified when you specify "Bellows", but installation costs are less; and you know wherever your machine is shipped, a Bellows Field Engineer will be available for service if it is ever needed.

Write for Bulletin BM-25
"The Story of The Bellows Air Motor"
Address: Dept. TP-1256
The Bellows Co., Akron 9, Ohio

The Bellows Co.

AKRON 9, OHIO

In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ont.

644B

CIRCLE INFORM-A-GRAM KEY NO. 115

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These things can mean you'd be better off by buying your stampings from a high quality outside source like Laystrom. You get better stampings from Laystrom, faster, and with less headaches. Our technical men work with stampings all the time. It's our specialty. Our years of experience assure you that your stamping problems will be solved in the most economical way. We take advantage of all possible opportunities to do every job with the fewest possible steps, creating savings in labor and material *which are passed on to you in the form of lower unit costs.*

On your next job, let us know your requirements and figure on them. You may be surprised at the savings and benefits we can offer you. Send your drawings today!

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☐ **We are sending drawings for quotation.**
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Manufacturers of the Layco Tru-Align Die Setup

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FILMS TO SEE

Sheffield Corp. has available several films. "Why Gamble in Gages?" covers the manufacturing and inspection procedures in the manufacture of fixed gages. The facilities available for contract services for research, engineering, manufacturing and inspection are covered in "At Your Service." "Machining the Unmachinable" describes the ultrasonic machine processes for machining hitherto unmachinable materials. It provides case history information and covers fundamental techniques of employing ultrasonic energy for drilling, carving and bossing, tapping, slicing and dicing of unmachinable materials. These films are issued on a free-loan basis by Sheffield Corp., Dayton 1, Ohio.

◆

"Techniques of Surface Grinding" presents the operating methods and design factors affecting good results in surface grinding, and the striking diversity in modern surface grinder applications. Defined, with demonstrations of performance, are the desirable characteristics of a surface grinder. The features of construction, lubrication and mechanical design are also shown. In addition, proper methods for dressing and balancing grinding wheels are described and demonstrated. This film is loaned free of charge by The DoAll Co., Des Plaines, Ill.

◆

Pennsylvania State University has obtained the movie, "Productive Maintenance" from General Electric Co. The film will be used to incorporate the latest industrial maintenance techniques in the university's engineering courses. It will help student engineers better understand the roles of maintenance and automation in modern industry.

◆

"Quality Unlimited," a sound-color film describing the manufacture of wire rope, has been made available by the Wickwire Spencer Steel Division of The Colorado Fuel and Iron Corp. The film follows all the operations from basic steel making to the testing of the finished rope. Special emphasis is given to the chemical and physical tests that accompany every step in the manufacturing process and insure high quality wire rope. Applications and proper care of wire rope are also illustrated in the film. For information on obtaining the 30-min movie, contact The Colorado Fuel and Iron Corp., 575 Madison Ave., New York 22.

An open letter

PUNCH PRODUCTS Corporation

UNIPUNCH

Telephone 4-0476

TO PRODUCTION MEN INVOLVED IN TOOLING:

You are invited to call on the experience of Punch Products' Engineers, who have personally accumulated over 90 years of know how" in the field of Unitized Tooling, to recommend the most efficient and economical method of producing punched or notched parts.

Many leading manufacturers have taken advantage of this personalized engineering by calling in our experienced personnel or sending us part prints for analysing their complete tooling program ---- large or small. From this information, we submit comparative cost charts showing the savings produced by UNIPUNCH Tooling over present methods. In many cases, the savings more than pay for UNIPUNCH Tooling during the first production run.

You, too, will know how much you save before you go into production --- even before you invest in UNIPUNCH Equipment --- by sending us a set of part prints for our recommendations and cost analysis. No obligation, of course.

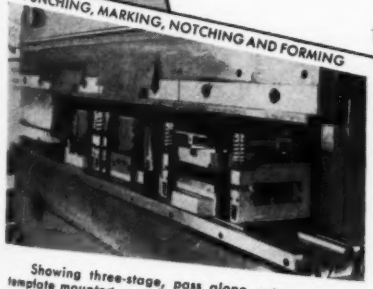
Your inquiry will receive my immediate attention.

Very truly yours,

Jerome F. Ferdinand

Jerome F.Ferdinand
Sales Manager

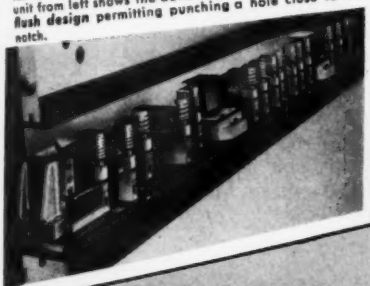
PUNCHING, MARKING, NOTCHING AND FORMING



Showing three-stage, pass along, set-up which is template mounted on a #5100 Unipunch Bed Rail. First operation, beginning at right, punches 2 holes and numbers part. Second operation punches 3 holes and notches 2 corners. Third operation forms part. Note samples on ram.

Showing set-up of combination hole-punching and notching with finished work piece in foreground. Series A Units punch and notch material from shim stock to ¼" thick.

Set-up of UNIPUNCH Series A Hole-Punching and Corner Notching Units on a strip template mounted on a #5000 bed rail in a press brake. The seventh Unit from left is a UNIPUNCH Edge Notching Unit. The second unit from left shows the advantage of UNINOTCH Unit flush design permitting punching a hole close to the notch.



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PUNCH PRODUCTS Corporation

CIRCLE INFORM-A-GRAM KEY NO. 117

Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

New Materials for Zinc Phosphate Coatings are described in the booklet, "How to Apply Zinc Phosphate Coatings to Steel in Preparation for Painting." Four reasons why the Oakite CrysCoat process is efficient, reliable and easy to control, are presented. This process converts the steel surface into a heavy phosphate layer chemically bound to the metal. Common uses, solution strength and temperatures are detailed in the booklet. Request copies from Oakite Products, Inc., 157 Rector St., New York 6, or —
Circle Inform-A-Gram No. B1.

A 1700-Lb Pot Capacity is a feature of the No. 2 die casting machine. It also provides positive die locking; safe, convenient controls; and fast die set-up. This high pressure plunger gooseneck die casting machine can be used for zinc, tin or lead base alloys. For a description of the machine and its features, photos, a schematic drawing and specifications, get a bulletin from Reed-Prentice Corp., Worcester 4, Mass., or —
Circle Inform-A-Gram No. B2.

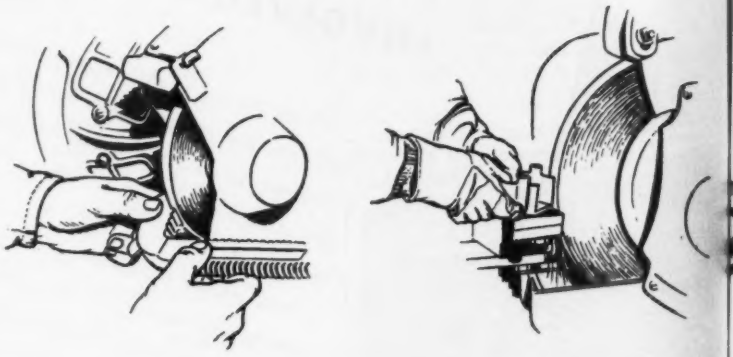
121 Metals and Alloys for standard and special small diameter tubing are listed in Data Memorandum 1 published by Superior Tube Co., 1733 Germantown Ave., Norristown, Pa. They are grouped into carbon, alloy and stainless steels, nickel and nickel alloys, copper and copper base alloys, glass sealing alloys, reactive metals and nickel cathode materials. They are also grouped as to whether standard or special analyses.
Circle Inform-A-Gram No. B3.

The New 1956 Air Power Catalog is now available from Mead Specialties Co., 4114 N. Knox Ave., Chicago 41. It covers both air cylinders and air operated devices. They are described complete with an illustration and mounting diagram. Also given are examples of air power setups. Further details are found in the catalog available from the company, or —
Circle Inform-A-Gram No. B4.

Precision Layout Tools for the toolroom are covered in a circular from Kurval File and Tool Co., 494 Franklin St., Buffalo 2. Included are a layout compass, scriber, scraper, and needle files and rifflers. Each is illustrated with a brief description.
Circle Inform-A-Gram No. B5.

61 Conomatic Models are highlighted in a bulletin published by Cone Automatic Machine Co., Inc., Windsor, Vt. The features of the machines are detailed complete with photos. These bar and chucking machines have accessible and adjustable camming. Also covered are attachments. For full details, obtain copies of the bulletin from the company, or —
Circle Inform-A-Gram No. B6.

For Hole Deburring and Chamfering openly accessible hole faces, use the Nobursink Tool. The Noburod Tool will deburr and chamfer the outer ends of rods, tubes and bosses. A bulletin covers design and operating features, and specifications. Also included are before and after photos. For copies of Bulletin 656, contact Nobur Mfg. Co., 6860 Farmdale Ave., North Hollywood, Calif., or —
Circle Inform-A-Gram No. B7.



Great news about your general purpose grinding

You get the profit-boosting "TOUCH of GOLD" from Norton general purpose wheels — as you do from the Norton wheels on your production jobs

Remember this about your general purpose bench and floor stand grinding, and mounted wheel operations . . . *Norton builds wheels in every abrasive-and-bond combination you need.* In particular, 44 ALUNDUM* abrasive is the new, revolutionary Norton development that's tops among all non-premium priced aluminum oxide abrasives. Tough, versatile "44" wheels solve plenty of grinding problems for new users — with outstanding performance for less money.

So Easy For You To Get

Your Norton Distributor, one of over 315 in the United States alone, is your contact with the largest, most efficient service and supply system in the entire abrasive field. He'll give you fast deliveries on the wheels you want, plus details on how Norton wheels bring the product-improving, profit-boosting

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Modified and Equipped for Automation are straight side, single action eccentric geared presses produced by Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11. Series SE-1, 2 and 4 presses are used in large die area, heavy tonnage drawing, punching and blanking work. The features of these presses are covered in Bulletin 66 Supplement released by the company, or — **Circle Inform-A-Gram No. B8.**

Milling, Boring, Routing and Drilling are handled by Standard super precision milling spindles. These motorized spindles, including infinitely variable speed, fluid drive, liquid cooled and other types, are detailed in a bulletin. Each is shown complete with specifications. Obtain copies of Bulletin C15 from The Standard Electrical Tool Co., 2488-96 River Rd., Cincinnati 4, O., or — **Circle Inform-A-Gram No. B9.**

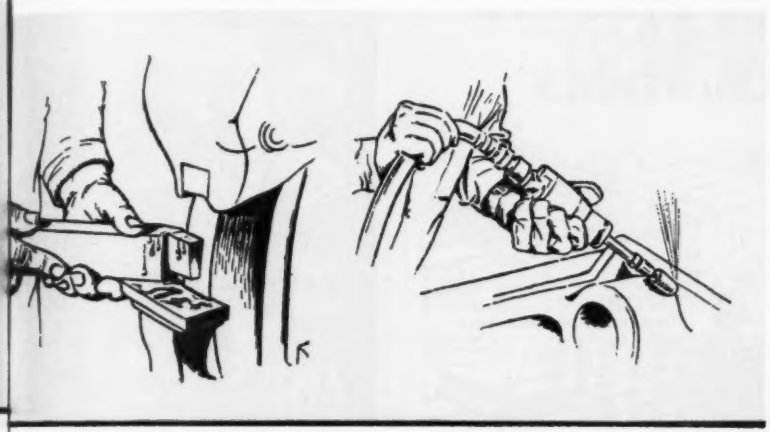
Refrigeration Applied to Metalworking by the Mistic-Mist method is detailed in a folder from Aetna Mfg. Co., Bensenville, Ill. As an example of the benefits to be gained, this method assures complete visibility with increased wheel life on carbide tool grinders. The folder notes the advantages of using the Mistic-Mist method of cooling on other applications as well and the results which can be expected. Also given are prices and a list of standard equipment and accessories. **Circle Inform-A-Gram No. B10.**

Designed for High-Volume Flat Surfacing of ferrous and non-ferrous metals, glass, plastics, etc. are multiple-head conveyor-type abrasive belt grinders. They produce extremely fine finishes to exacting tolerances and make possible a single cycle operation from rough grind to final polish. A bulletin including photos, specifications and illustrations of processed parts can be obtained from Engleberg Huller Co., Inc., 831 W. Fayette St., Syracuse 4, N. Y., or — **Circle Inform-A-Gram No. B11.**

Power-Grip Magnetic Chucks are used for surface grinder applications. These chucks are detailed in Bulletin 572-M from Sundstrand Magnetic Products Co., 1020 Ninth St., Rockford, Ill. Included is a discussion of an improved electromagnetic principle, some typical installations and specifications. Also listed are the advantages of Sundstrand design. **Circle Inform-A-Gram No. B12.**

An Infinite Reduction Ratio Range is a feature of a heavy duty pantograph engraver. Model D2 will engrave both small and large objects. An adjustment of a calibrated hand wheel makes the change from engraving a one inch name plate to a mounted instrument panel. Green Instrument Co., Inc., 385 Putnam Ave., Cambridge 39, Mass., or — **Circle Inform-A-Gram No. B13.**

Speed Reducers and Gearmotors are featured in Catalog 51 released by Abart Gear & Machine Co., 4834-36 W. 16th St., Chicago 50. Each model is shown complete with features, specifications and diagrams. In addition, information is included on speed reducer selection. For complete information, obtain a copy of Catalog 51 from the company, or — **Circle Inform-A-Gram No. B14.**



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This latest Norton wheel catalog brings you plenty of information and recommendations on the types of wheels that will give you best results in your particular grinding jobs. List prices are there, too — and also included is a brand new supplement covering discount net prices for the complete line. Get it now from your Norton Distributor. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellowpages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

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CIRCLE INFORM-A-GRAM KEY NO. 119

The Diamond Block Method of Atmospheric Control for hardening high speed steel is detailed in a 12-page bulletin. Also discussed is high speed steel hardening at minimum cost as performed by Sentry Model "Y" electric furnaces. The various models available are illustrated and described in the bulletin. Bulletin 1054, complete with specifications and general information, can be obtained from The Sentry Co., Foxboro, Mass., or —
Circle Inform-A-Gram No. B15.

Crankshaft Grinding Wheels are discussed in detail in Bulletin ESA-263 recently released by Simonds Abrasive Co., Tacony and Fraley Sts., Philadelphia 37. Information is included for multiple spindle setups for grinding main or line bearings, and for single wheel setups for pin bearings. Also given are recommendations and grain and grade specifications. Copies of the bulletin are supplied by the company, or—
Circle Inform-A-Gram No. B16.

ARMSTRONG
Quality TOOLS
ARMSTRONG TOOL HOLDERS
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.
ARMSTRONG HIGH SPEED
Ready-to-grind Bits Ready-ground Cutters
ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades of hardness.
ARMSTRONG BORING TOOLS
6 types with boring bars in sizes for all boring and internal threading work. Hold cutters at 90°, 45° and 30°
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have high speed steel form cutters, require only top grinding to resharpen. Hold true thread form. Rigid and "Spring" types.
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Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.
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Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also drop forged Machinists' Clamps.
ARMSTRONG Setting Up Tools
A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.
ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes, Drop Forged and heat treated.
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All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible
ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel Over 100 types in all sizes. Improved designs, steels, and heat treating give greater strength.
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All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.
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Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vises.
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Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
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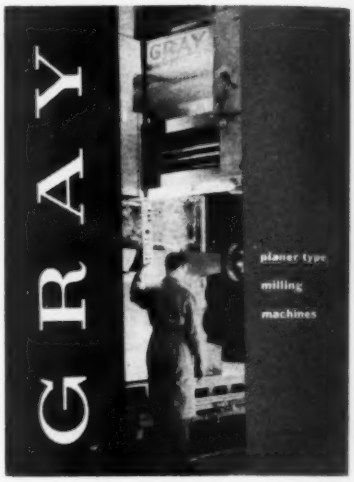
CIRCLE INFORM-A-GRAM KEY NO. 120

No Pallets Are Needed with the Standard Unitizer, which offers all the advantages of conventional palletizers and pallet-load handling. Unit loads automatically assembled by the Unitizer directly from a connected conveyor are handled by clamp type trucks. The Unitizer works on simple proven air, hydraulic and electrical circuits. Copies of Bulletin 46 covering the Unitizer's features and operation can be obtained from Standard Conveyor Co., North St. Paul 8, Minn., or —
Circle Inform-A-Gram No. B17.

Planer Type Milling Machines are detailed in Bulletin 62 announced by The G. A. Gray Co., 3611 Woodburn Ave., Cincinnati 7. The first section of the bulletin is devoted to photos



of actual installations. The remainder of the bulletin covers the features of the milling machines, complete with photos. Also included are machine specifications and supplemental equipment.
Circle Inform-A-Gram No. B18.

A Feed Finger Pad Stocklist is now available from Edgcomb Steel of New England, Inc., Milford, Conn. Covered are Lascote "L" style carbide plated feed finger pads. Also given are general information and a decimal equivalent chart. Get your copy from the company, or —
Circle Inform-A-Gram No. B19.

"The A.B.C.s of Modern Lubrication" discusses the Bijur system of automatic metered lubrication. This system has three elements — lubricator, distribution system and meter-unit. The bulletin describes and illustrates these in detail. Contact Bijur Lubricating Corp., Rochelle Park, N. J., for a copy of this bulletin, or —
Circle Inform-A-Gram No. B20.

Positive Protection against rust, abrasion and corrosion for all metal parts and tools is provided by a non-oil exuding compound developed by Bischoff Chemical Corp., Ivoryton, Conn., and added to its line of strippable protective coatings. Thermo-Cote N-4 is designed for specific applications such as masking surfaces in plating, or etching operations. Complete details are in Form 656 provided by the company, or —
Circle Inform-A-Gram No. B21.

A Handy Guide to aid in selecting and operating the Di-Acro punch press and notcher is provided by a bulletin available from O'Neil-Irwin Mfg. Co., 300 - 8th Ave., Lake City, Minn. Given are specifications, capacities, construction features, illustrations and details on the equipment available. Also given are operating instructions for hand and power operated punch presses, and hand and power operated notchers.
Circle Inform-A-Gram No. B22.

Accessories and Attachments for Toolmaster milling machines are described and illustrated in Supplement M-1870-3-S released by the Cincinnati Milling Machine Co., Cincinnati 9. These include shaping tools and attachments, index head and tailstock, vises, overarm adapter, power feed to table and saddle, and precision measuring equipment. For your copy, contact the company, or —
Circle Inform-A-Gram No. B23.

With "Hy-Power" Hydraulics, design engineers and toolmakers can create cost reducing production equipment. A bulletin discusses the Hy-Power system and operating characteristics and cycle. Also detailed are the applications of the system, standard equipment and ordering information. For complete information, obtain a copy of Bulletin 150 from Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill., or —
Circle Inform-A-Gram No. B24.

A Universal Power Grooving Machine equipped with a multi-purpose horn for closing both single and Pittsburgh lock seams, is highlighted in Bulletin 76-C issued by Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11. The bulletin includes specifications for hand operated and giant power groovers in addition to Model 48-U. Also given are step-by-step illustrations of single and Pittsburgh lock seaming.
Circle Inform-A-Gram No. B25.

Products and Services of Fawick Airflex Div'n, Fawick Corp., are described in a 36-page bulletin. Included are history, applications and design data on Airflex clutches, brakes, couplings, power take-offs, Rotorseals, quick release valves and high-speed controls. Also presented are detailed drawings and tables. For your copy of Bulletin 500-A, write to Fawick Airflex Div'n, Fawick Corp., 9919 Clinton Rd., Cleveland 11, or —
Circle Inform-A-Gram No. B26.

Many Different Applications, such as feeding and storing gear blanks, bearing races, pistons, tappets, many screw machine products, etc. are found for the "Z" automatic float and feeder. It will feed a single machine or a bank of machines. The float and feeder carries a bank of parts which it automatically stores and/or feeds on machine demand. For further details, see Circular Z-10 released by Cargill Detroit Corp., 2254 Cole Ave., Birmingham, Mich., or —
Circle Inform-A-Gram No. B27.

5603

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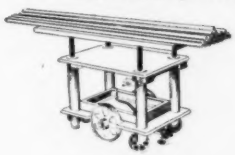
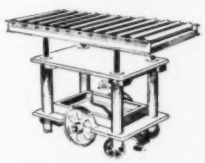
NEW Convenience
NEW Capacities
NEW Designs

PORTELVATOR®

The Handy HAMILTON Portable, Elevating Table





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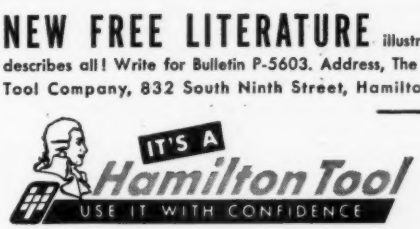
NEW provision for raising and lowering overhanging loads!

NEW convenience in maneuvering! Six wheel models roll easier . . . turn shorter.

NEW overhanging conveyor tops!

More stamina, more versatile performance than ever before

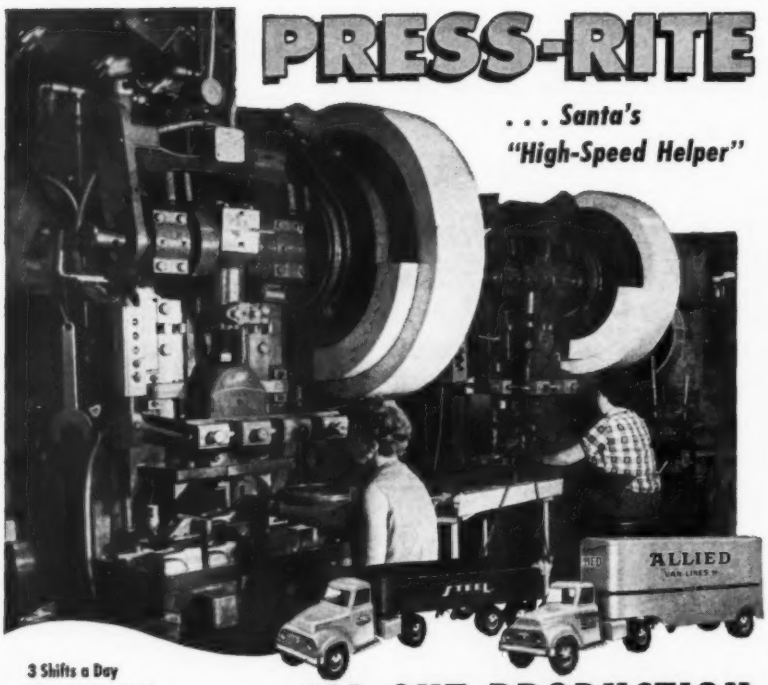
NEW FREE LITERATURE illustrates and describes all! Write for Bulletin P-5603. Address, The Hamilton Tool Company, 832 South Ninth Street, Hamilton, Ohio.



CIRCLE INFORM-A-GRAM KEY NO. 121

Over 700 Standard Precision Carbide Tipped Tools are included in the new catalog published by Nelco Tool Co., Inc., 266 Center St., Manchester, Conn. These tools are engineered to efficiently perform over 90% of all metalworking operations. Among the tools covered are arbors, boring bars, carbide tips, centers, diamond wheels, end and face mills, keyseat cutters and special tools. The company will provide copies of the comprehensive catalog, or —
Circle Inform-A-Gram No. B28.

Specifications, Dimensions, Ratings and Applications are given on Series DSC, Series SA silent chain couplings and Series DRC roller chain couplings, in a 16-page catalog. Information is also tabulated on stamped steel, plastic and split aluminum covers. Also explained are the purpose and function of flexible chain couplings. Get your copy of Catalog C45-56 from Morse Chain Co., Industrial Sales Div'n, Ithaca, N. Y., or —
Circle Inform-A-Gram No. B29.



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. . . Santa's "High-Speed Helper"

3 Shifts a Day
Seven Days a Week
that's the year 'round
schedule at
Tonka Toys

ALL-OUT PRODUCTION
at the TONKA TOYS Factory

True-to-life truck bodies are made of 20 gauge steel drawn to a depth of 2¾ inches.

Chassis, cabs, wheels, etc., are turned out by the thousands at Tonka Toys . . . and each one has to be *perfect* to pass the critical inspection of today's boys and girls.

Press-Rite Presses do the job better

Increased Die Life . . . the experience of Tonka Toys proves that Press-Rite's tie rod frame design gives rigidity that really pays off in reducing costly die wear. You get longer runs between die grinds and keep dies at peak efficiency. The Press-Rite Airflex Clutch protects dies against accidental breakage as air-pressure is adjusted for-the-job and allows the clutch to slip on "double headers"

Mound Metalcraft Company, the home of Tonka Toys, is now one of America's leading toy manufacturers. Their rapid growth is symbolized by their "repeat orders" year after year for additional Press-Rite Presses.

Press-Rite Presses ... **Airflex Clutches** . . . that's the combination that the folks at Tonka Toys have found gives them the highest production . . . at the lowest cost per unit.

PRESS-RITE has many exclusive features to make it today's TOP PRESS VALUE. Send for Catalog Today—get the money-saving facts on the Press-Rite Line. Speed Production and Cut Costs in your plant.

SALES SERVICE MACHINE TOOL CO.
2351 W14 University Ave., St. Paul 14, Minn.

PRESS-RITE
OPEN BACK • INCLINABLE *Power Presses*
Used by more . . . for more production

CIRCLE INFORM-A-GRAM KEY NO. 122

A Proximity Switch, Model T-271, is used to detect the presence of a ferrous object without requiring physical contact. A bulletin describes the switch and lists applications. Also shown is a typical application. In addition, installation diagrams and performance specifications are presented. Doelcam, Div'n of Minneapolis-Honeywell Regulator Co., 1400 Soldiers Field Rd., Boston 35, will provide copies of Bulletin PS, or —
Circle Inform-A-Gram No. B31.

Material Handling Equipment and Stacking Racks for Industry are highlighted in a new catalog released by Equipment Mfg. Inc., 21550 Hoover Rd., Box 3838, Detroit 5. Pictured and described are portable stock racks, tables and stands, pallet racks, and pallets and skids. Also shown are coil racks, stock and hopper boxes, portable scrap boxes, dolly racks and storage racks for special applications.
Circle Inform-A-Gram No. B32.

A Production Rate of 300 to 450 Blanks/Min is a feature of the Headmaster solid die double stroke cold header. A bulletin covers the specifications and various design features, and explains in detail the advantages of the toggle type construction used for actuating the heading gate. In addition, a table is included showing the maximum and standard tool sizes for the Headmaster. Copies of the bulletin detailing the header are made available by The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., or —
Circle Inform-A-Gram No. B33.

The Lift-A-Load Elevating Table Shop Truck provides an answer to tool and material handling problems. This shop truck has three table surfaces for storing equipment while moving. For design features and specifications, get a circular on the Lift-A-Load shop truck from Dayton Rogers Mfg. Co., 2824-13th Ave., S., Minneapolis 7, or —
Circle Inform-A-Gram No. B34.

The Sigmatic Mechanical Comparator assures economical quality control of profitable production. This self-contained, portable comparator is a precision instrument designed for close tolerance inspection. It can be used on the inspection bench or at the machine to check a

wide variety of work types and sizes. A bulletin covers the comparator's features and operation, and shows actual size standard scales. Details are found in Circular 599 published by Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn., or — **Circle Inform-A-Gram No. B35.**

Knife Selection and Setting Instruction are included in a Shear Selector Chart issued by Simonds Saw and Steel Co., Fitchburg, Mass. Covered are high chrome steel, special alloy steel and high speed steel knives. Also given on the chart is information on spacing collars and separator discs. For your copy of the illustrated chart, contact the company, or — **Inform-A-Gram B36.**

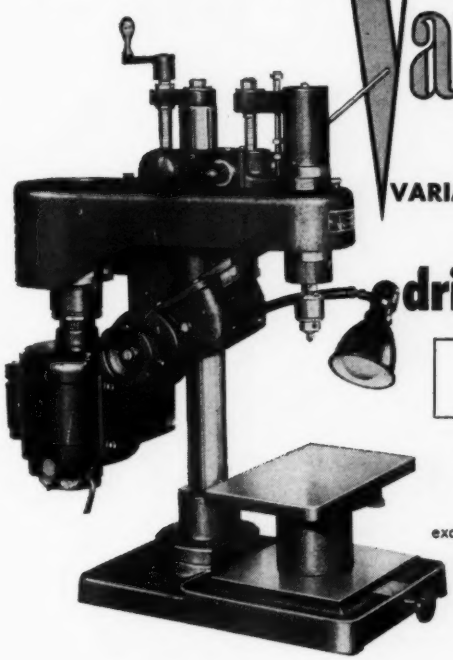
Manual, Semi-Automatic and Automatic Wet-Blast Equipment is detailed in a catalog issued by The Cro-Plate Co., Inc., 747 Windsor St., Hartford, Conn. Included are illustrated case histories covering a wide range of "Pressure Blast" wet-blast job applications. Also shown are the various standard units available and full details on the type of abrasives employed in the process. **Circle Inform-A-Gram No. B37.**

Bench and Floor Model Hand-Tappers are covered in a brochure from Tools, Inc., 1733 N. 25th Ave., Melrose Park, Ill. An infinite number of holes can be tapped with one setting and clamping of the workpiece. The tappers feature articulated arms, individual spindles, vise and tee-slotted table. For copies of the brochure, contact the company, or — **Circle Inform-A-Gram No. B38.**

Accurate, Industrial Multi-Channel Counting with speeds up to 30 counts/sec on each channel is performed by a multi-channel input unit. Model MC is designed for all types of industry where a total count of daily production is required from more than one line. Features, details and specifications are found in Bulletin PD-23 available from Post Machinery Co., Electronic Products Div'n, 140 Elliott St., Beverly, Mass., or —
Circle Inform-A-Gram No. B39.

A New Vise and Work-Holding Equipment Catalog is now available. It gives full information on a line of machine tool vises, angle vises, adjustable angle plates, adjustable lathe fixtures, safety workholders for drill presses, quick-acting vises, large capacity mill table vises and parallel clamps. These vises and fixtures assure easier, quicker setups. Universal Vise & Tool Co., Parma, Mich., will supply copies of Catalog 9156, or —
Circle Inform-A-Gram No. B40.

HAMILTON Varimatic®
SUPER SENSITIVE
VARIABLE SPEED • SMALL HOLE
PRECISION
drilling machine
SINGLE OR
MULTIPLE SPINDLES



to drill holes (.004" to 5/16") in all drillable materials, to the most exacting specifications and on the most relentless production schedules.

Get prices and specifications without obligation.
ASK FOR FREE BULLETIN 5407
Address The Hamilton Tool Company
832 South Ninth Street
Hamilton, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 123

The New Lincolnweld Submerged Arc Welder offers an unlimited choice of welding controls, power sources and mounting features. A bulletin covers Models LAF-3, LAF-4 and LAF-5 and details the attachments which are available to use with them. One section is devoted to power sources for AC and DC operations and another to electrodes and fluxes. The Lincoln Electric Co., Cleveland 17, will make available copies of the bulletin, or — **Circle Inform-A-Gram No. B41.**

A Complete Line of Rotary Gang Slitters for mills, warehouses and strip users is found in a 16-page booklet. Included are photos of actual slitting operations, tables of cutting capacities and machine specifications. Both sheet and coil slitting methods are summarized. One section is devoted to various types of recoiling equipment and methods. Stanat Mfg. Co., Inc., 47-28 - 37th St., Long Island City, N. Y., will issue copies of Publication 569, or — **Circle Inform-A-Gram No. B42.**

*Now they call Joe a genius**

* He's no Einstein — but he figured how to cut costs in half by switching to...

NEW T-J REAMERS

with *throw-away heads!*

You don't have to be a wizard at figures to see how the new T-J Reamer with Throw-Away Head cuts your replacement costs to *less than half*. You *save* because you replace *only* the part that wears out. Buy original shank . . . change the head in a jiffy when worn. Wide range of head sizes from ½" to 2¾" inclusive, in 1/16" increments available with right or left hand spiral flutes for thru or blind hole reaming.

Tapered hole in head insures concentricity and *new* thread design assures a snug fit on smoothly ground tapered shank. Reamer operates free from binding or sticking due to cutting portion wearing undersize and creating negative relief. It's a product of T-J's 39 years of know-how as one of the largest manufacturers of die sinking milling cutters. Tomkins-Johnson Co., 617 North Mechanic St., Jackson, Mich.

1–Cuts replacement cost to less than half!
2–Quick change of heads saves time.
3–Wide range of sizes.
4–Head and arbor firmly locked together.
5–Easy to change heads for different metals, increases efficiency.

★Exclusive, high potential territories open to responsible manufacturers representatives. Write today!

T-J TOMKINS-JOHNSON

CIRCLE INFORM-A-GRAM KEY NO. 124

A Straight-Line Press Unloader for a wide variety of stamping and forging press automation applications is described and illustrated in a new catalog. Specifications are included for four standard sizes of unloaders having strokes from 12" to 48". Also covered are a line of four models of standard jaw assemblies, which are made in three types and can be installed without alteration on conventional swinging-arm styles of press unloaders. Press Automation Systems, Inc., 18616 Wyoming Ave., Detroit 21, will provide copies of the catalog, or — **Circle Inform-A-Gram No. B43.**

Precision Tools are the subject of a catalog from R and L Tools, 1825 Bristol St., Philadelphia 40. Turning tools, tap and die holders, universal tool post, cutoff blade holders, and knurling and recessing tools are among the tools covered in the catalog. The catalog is complete with prices, specifications, diagrams, photos and general information on the tools.
Circle Inform-A-Gram No. B44.

Choose the Size of Magnet needed for Dilley Grip Shields. Regular base and giant base magnetic Grip Shields are now available. These Grip Shields afford protection against flying shop-flak, chips, dust or splash. For copies of a bulletin listing the sizes available, containing descriptions and showing typical applications, write to The Dilley Mfg. Co., 1656 Doan Ave., Cleveland 12, or — **Circle Inform-A-Gram No. B45.**

A Testing Machine for creep and stress-rupture tests is featured in Bulletin RR-13-56 from Riehle Testing Machines, Div'n of American Machine and Metals, Inc., East Moline, Ill. It is available in 12,000-lb and 20,000-lb capacities. In addition to detailing the equipment found on the machine, the bulletin lists other testing machines produced by the company.
Circle Inform-A-Gram No. B46.

Speed, Accuracy, Milled Finish and Low Cost are advantages of circular sawing. No. 00 circular sawing machine is used for ferrous and nonferrous metals and for smaller stock up to 1¼" dia. The No. 00 Series is available in a variety of models for cutting squares, structural shapes, round solids and tubes, from titanium to magnesium. Complete details are found in Bulletin 75 provided by The Motch & Merryweather Machinery Co., Penton Bldg., Cleveland 13, or —
Circle Inform-A-Gram No. B47.

Drive Screws from size No. 8 down to No. 0 dia to perfect preset tightness, without breaking or burring the screw and without scratching or marring the finished surface, with No. 8 Scrugun. This model and Nos. 10 and 12 Scruguns and the Holgun

and the Tapgun feature power-speed control. For details and specifications, get a bulletin from Black & Decker Mfg. Co., Towson 4, Md., or — **Circle Inform-A-Gram No. B48.**

Quick Change to New Pallet Pattern is a feature of Model G automatic pallet loader. It has a capacity of 20 to 30 cartons/min and can be used with a capacity as low as 5/min. A bulletin, Form PL-301-56, covering the operation of the pallet loader, sizes of pallets, pallet patterns and loads, capacity, products handled and a plan view, is supplied by Lamson Corp., Syracuse 1, N. Y., or—
Circle Inform-A-Gram No. B49.

Applications of standard Intermittor rotary and Trans-O-Mator in-line automatic assembly machine bases are presented in Bulletin 500 released by Ferguson Machine Corp., Hicks Development Div'n, P.O. Box 350, Lebanon, Ind. Emphasized is the versatility of the bases. Hicks Development specializes in complete automatic machinery development using standard Ferguson assembly machine bases.
Circle Inform-A-Gram No. B50.

Television for Industry is covered in a bulletin released by Farnsworth Electronics Co., Fort Wayne, Ind. Detailed are the features of Model 300A and the monitor and camera which make up the system. Also listed are applications and accessories. In addition, performance, cooling, environmental and physical specifications are included.
Circle Inform-A-Gram No. B51.

Isomode Pad Installation, as low-cost machine mountings, is described in a revised four-page bulletin. The pads are used in controlling vibration, absorbing impact and reducing noise. The bulletin is illustrated with photos of actual machine installations and cross-section drawings of three basic mounting methods. Write to MB Mfg. Co., 1060 State St., New Haven 11, Conn., for copies of Bulletin 415B, or — **Circle Inform-A-Gram No. B52.**

A Complete Line of standard, integrated Panalarm Annunciator Systems for industry is found in a 32-page catalog. One section illustrates typical industry applications. Other sections are devoted to presenting operating sequences, enclosures, mechanical specifications, technical data and performance features. Request Catalog 100B from Panalarm Div'n, Panellit, Inc., 7401 N. Hamlin Ave., Skokie, Ill., or — **Circle Inform-A-Gram No. B53.**

2428

The Hamilton No. 1-B Precision, Small-Gear Hobbing Machine. Speed, feed, and indexing each can be selected independently. *Consider that!*

YAK!
YAK!
YAK!

WE won't take your time to extol the virtues *nor* to rehearse the specifications of the Hamilton No. 1-B Precision, Small-Gear Hobbing Machine. Let us make but one point! *If* you have *small, precision* gears to make, be they spur, spiral, bevel, or face gears, *INFORM YOURSELF** about the Hamilton!

*We will provide full information

FREE

Ask for illustrated Bulletin No. 2428 (No. 2428-A if you are interested in small, precision spur gears only.)

ADDRESS

THE HAMILTON TOOL COMPANY
832 South Ninth Street
HAMILTON, OHIO

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

CIRCLE INFORM-A-GRAM KEY NO. 125

Automatic Plating and Processing Machines are highlighted in a bulletin issued by The Udylite Corp., Detroit 11. These machines feature rack capacities in excess of 1000 lbs and variable rack spacing. They provide positive hydraulic overload protection on lift and transfer. In addition, the illustrated bulletin lists other operating advantages. Obtain copies of the bulletin from the company, or —
Circle Inform-A-Gram No. B54.

The Landis 4" Concentric Grinder is described in a new catalog. Bearing races or rings for precision mechanisms can be O.D. ground within the closest limits for concentricity. This is a shoe-type centerless grinding method for ring shaped parts with either straight or profiled shapes. Landis Tool Co., Waynesboro, Pa., will provide copies of Bulletin CX-56 detailing the grinder, or —
Circle Inform-A-Gram No. B55.

Production and Toolroom Grinding are performed by Model 824 Reid-O-Matic precision surface grinder. This electric, fully automatic grinder features finger-tip control for all grinding operations. An illustrated bulletin lists the grinder's features and specifications. Obtain your copy of the bulletin from Reid Brothers Co., Inc., Beverly, Mass., or
Circle Inform-A-Gram No. B56.

Lapping and Electrolizing
Make Taft-Peirce Gages
Wear Many Times Longer!
Your money goes a long, long way when you order T-P Electrolized Gages! The combination of lapping plus electrolizing means that every gage will stay accurate, longer. Precision lapping produces an exact-sized gage — no "hills" and "valleys" to wear rapidly and destroy gage accuracy. Electrolizing puts an even film of hard, non-magnetic alloy on all gaging surfaces to give exceptional wear resistance. Initially costing only slightly more than ordinary hardened steel gages, Taft-Peirce Electrolized Gages more than pay for the difference in longer gage life. Result: Your budget for gages goes much farther, and your inspectors work with the best accuracy you can buy. For more information, call or write: The Taft-Peirce Manufacturing Co., Woonsocket, R. I.
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Air Gages
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Precision Gages
Tool-Room Specialties
Grinding Machines
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THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND
T-P Means TOP Precision
CIRCLE INFORM-A-GRAM KEY NO. 126

Non-Contacting Radiation Gages provide quality control for continuous material production. With Rad-I-Acc gages, accuracy in millionths of an inch can be obtained on very thin materials. Two types of non-contacting radiation gages are available — X-ray gages and beta ray gages. Complete details are found in Bulletin 600 issued by Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn., or —
Circle Inform-A-Gram No. B57.

Locate Cracks in Any Solid Material by means of spray-on dye penetrant inspection. Spotcheck dye penetrant test kits are used for inspecting small questionable areas and remotely located parts at any time. A new kit, Spotcheck Kit SK-3, with all pressurized spray cans is now available. Full details are found in a folder provided by Magnaflux Corp., 5900 Northwest Hwy, Chicago 31, or —
Circle Inform-A-Gram No. B58.

"New Dollars for You" describes the time and money saving qualities of the Howe & Fant turret drilling machine. Covered are such points as initial cost, power and maintenance cost, floor space savings, set-up, handling and downtime. Also included is a summary of annual savings. Copies of Bulletin 55-11 can be had by contacting Howe & Fant, 20 Fitch St., East Norwalk, Conn., or —
Circle Inform-A-Gram No. B59.

For Abrasive Finishing, Burring, Sanding, Buffing and Polishing on metal, plastic, etc., use the new Mathewson rotary finisher and buffer. A catalog sheet gives full details on the bench model rotary finisher with disc attachment which uses a standard hinged roll and turns at 1750 rpm. Write to Mathewson Machine Works, Inc., 80 Hancock St., Quincy 71, Mass., for copies of the catalog sheet, or —
Circle Inform-A-Gram No. B60.

Special and Standard Machines are illustrated and described in a catalog from Baker Brothers, Inc., P.O. Box 101, Station F, Toledo 10, O. These machines are used for

drilling, boring, tapping, keyseating and contour grinding. Also covered are the company's facilities for producing machine tools. The company will make available copies of the catalog, or —
Circle Inform-A-Gram No. B61.

21 Models of Air Cylinders are shown in new Catalog 110 published by The S-P Mfg. Corp., 30201 Aurora Rd., Solon, O. Series "A" nonrotating air cylinders range from 1½" through 14" bore sizes. The illustrated catalog contains complete engineering data on the company's line of standard air cylinders, valves and accessories.
Circle Inform-A-Gram No. B62.

"Tooling Tips" discusses standard "No-Chat" boring bars and solid boring tools. "No-Chat" bars assure smoother finishes and increased tool life, and increased speeds and feeds. Also covered in the catalog sheet are "No-Chat" cutoff tools. For copies of the catalog sheet with information on this development for better tooling with carbide, contact Wendt-Sonis Co., Hannibal, Mo., or —
Circle Inform-A-Gram No. B63.

Almetal Universal Joints are featured in an eight-page catalog from Detroit Bevel Gear Co., 8130 Jos. Campau, Detroit 11. Cutaway drawings and engineering dimensions and specifications are included for each of the joints in the company's line. In addition, the performance characteristics are described and the applications explained. Get your copy of the catalog from the company, or **Circle Inform-A-Gram No. B64.**

Servomation Building Blocks in various combinations will service a wide range of industrial control, design and telemetering requirements. A bulletin illustrates and describes analysis, electronic analog computer and mechanical computer components, and service units. Details on the Servomation building blocks are found in a brochure released by Servo Corp. of America, New Hyde Park, N. Y., or —
Circle Inform-A-Gram No. B65.

Designed for Delayed Control of high speed continuous process lines is the Magdelay magnetic memory system. It is also used for automatic sorting of items moving through complex conveyor systems. The features, operation, a typical application and two basic classes of sorting problems are detailed in a brochure now available from Automation, Inc., 212 Worcester St., Wellesley Hills 82, Mass., or —
Circle Inform-A-Gram No. B66.

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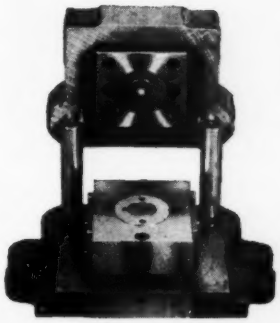
"You, too, should make washers the economical Hovis way. Save time, labor, materials and storage space"



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CIRCLE INFORM-A-GRAM KEY NO. 127

Self-Locking Unbrako Socket Screws are described in Form 2193 issued by Standard Pressed Steel Co., Box 600, Jenkintown, Pa. Examples are given suggesting a variety of applications in which vibration-proof screws can be used to eliminate the need for lock washers, wired heads or other extras. For complete information on sizes, specifications and critical dimensions, obtain the booklet from the company, or —
Circle Inform-A-Gram No. B67.

Perfect Precision Thickness Control for mass producers of jet engine blades is provided by the standard Multi-Jet gage. This gage is up to ten times as fast as pantograph and scissors gages. With it there is no alignment problem. The Multi-Jet gage is assembled from interchangeable precision-built components. Details are found in a bulletin from Winslow Mfg. Co., 1751 E. 23rd St., Cleveland 14, or —
Circle Inform-A-Gram No. B68.

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MICRO-SCRIBER®
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...lapped carbide tip resists wear, writes fast and easy on hard surfaces —tools, dies, glass, etc.

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▸ Micro-Scriber's tough carbide tip gets diamond-lapped to the precision point that gives you the correct angle for fast, easy, close-tolerance work. You'll find standardizing on Micro-Scribers pays off in your shop.

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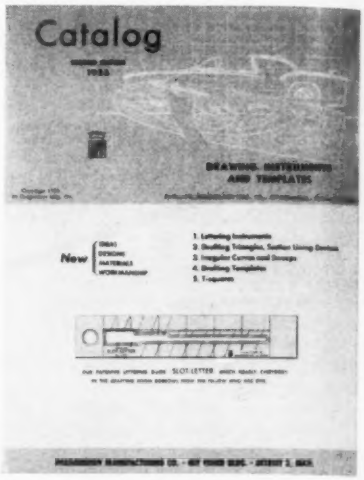
Precision Products since 1871

CIRCLE INFORM-A-GRAM KEY NO. 128

Drawing Instruments and Templates are featured in second edition 1956 Catalog published by Dolgorukov Mfg. Co., Fisher Bldg., Detroit 2. Included are lettering instruments, drafting triangles and section



lining devices, irregular curves and sweeps, drafting templates and T-squares. The company will provide copies of the catalog with details, or —
Circle Inform-A-Gram No. B69.

Meters for Compressed Air are the subject of Bulletin A-8 published by New Jersey Meter Co., Plainfield, N. J. Detailed are the Tool-Om-Eter and the Drill-Om-Eter. These meters measure the air consumption of any pneumatic tool, air motor, sand blast, air lift or other application of compressed air. The bulletin contains general information, photos of typical applications and installation data.
Circle Inform-A-Gram No. B70.

Vibratory Parts Feeders have been engineered and developed by Perry Equipment and Engineering Co., Erie, Pa. These vibratory feeders deliver small parts to assembly lines at a predetermined rate to help speed production. Catalog 356 covers the units available and lists the products that can be fed successfully. Request copies of the catalog from the company, or —
Circle Inform-A-Gram No. B71.

Mechanical C-Frame Punches and Shears can be furnished in various capacities and throat depths, single or double end, with plain or architectural type tables. These punches and shears are detailed in a bulletin. Each model is pictured and described. Charts give punch and shear capacity and specifications. Also shown are tools and attachments. Williams-White & Co., 301—6th St., Moline 1, Ill., will make available copies of the bulletin, Form 74, or —
Circle Inform-A-Gram No. B72.

William C. Mullin has taken over as sales manager for instrument gages of the Gage Division of Pratt & Whitney Co., Inc. He joined the firm in 1947. **Alexander S. Keller,** vice president and general sales manager, also disclosed that the sale of conventional gages has been combined with the sale of cutting tools under the direction of **Albert F. Miller,** the company's cutting tool sales manager.

◆

John J. Sayles has joined the sales engineering staff of W. O. Barnes Co., Inc. He will headquarter in Cleveland, working with Barnes' distributors in northeastern Ohio. Another addition to the sales engineering staff is **Sil. Dorazio.** His headquarters will be in Atlanta, Ga.

◆

Jack W. Woodard has taken over as southwest manufacturers representative of automatic drilling equipment for The Dumore Co. His territory includes Texas, Oklahoma, Louisiana, Arkansas and Kansas.

◆

The new advertising manager for Michigan Tool Co. is **Harold S. Atherton,** according to an announcement by **Marvin R. Anderson,** company president. Mr. Atherton formerly was with Denham and Co.

◆

Byron Nierenberg is the new chief application engineer for precision hydraulic and pneumatic components for Gar Precision Parts, Inc.

◆

J. J. Ricketson will represent The Cushman Chuck Co. in the central southern states. He is taking over the territory formerly covered by **Luther Broaddus,** who has retired.

◆

The newly created post of assistant sales manager for Firth-Loach Metals, Inc. has been filled by **E. J. Reitler.** In this position, Mr. Reitler is responsible for sales in the blanking and heading die fields.

◆

The Aro Equipment Corp. has promoted **Gene R. Voigt** to sales manager of the company's Air Tool Division. He will have charge of all domestic and export sales of Aro air tools, hoists and air equipment accessories.

◆

Verson Allsteel Press Co. has disclosed the appointment of **Donald Weiss** as district sales manager, Verson Allsteel Press Sales Co. Mr. Weiss will be in charge of the newly formed Verson direct sales office in Hamilton, Ohio.

Philip O. Geier, Jr. is now serving as assistant manager and **Harold W. Cottrell** as sales manager of the Cincinnati Milling Products Division of Cincinnati Milling & Grinding Machines, Inc. Mr. Geier has been with the company for over 17 years. Mr. Cottrell became associated with Cincinnati Milling in 1936.

◆

Charles G. Chisholm has been named general sales manager for Haynes Stellite Co., a division of Union Carbide and Carbon Corp. The announcement was made by **R. L. Lerch,** vice president-sales. Mr. Chisholm joined the company in 1933.

H. J. Andresen is sales manager of the new Crown Products Division of Hannifin Corp.

◆

Zero Mfg. Co. has announced the appointment of **George G. Gauck** as vice president in charge of sales. Mr. Gauck has had 20 years of sales and management experience.

◆

The appointment of **Anthony J. Snyder** as assistant to the vice president-sales has been announced by Firth Sterling, Inc. He formerly was with Morse Twist Drill and Machine Co. Mr. Snyder will represent Firth Sterling in the New England territory.

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This is the era of standardization. Porter Precision Products make HEAD PUNCHES and DIE BUTTONS from three types of the finest tool steel, and are available in any DECIMAL size.

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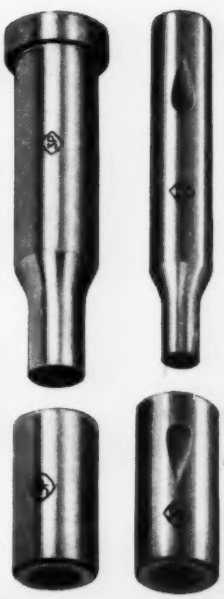

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CIRCLE INFORM-A-GRAM KEY NO. 129

MEN YOU SHOULD KNOW

Chedo P. Graham has been promoted to chief engineer of The Aro Equipment Corp. In his new position he is in charge of all engineering and research activities covering the company's industrial air tools, lubricating equipment and aircraft products.

◆

The appointment of **G. W. Kelch** as president of Borg-Warner Corp's. recently acquired Ingersoll-Humphryes Division has been disclosed. Mr. Kelch succeeds **D. J. Jones.**

Brian Sparks, who helped design the first U. S. jet plane, has become general manager of the Aircraft Division of Clary Corp. He will also continue in his post as chief engineer. The division designs and manufactures valves and other aircraft components.

◆

Earl R. Putnam has joined Fastcut Tool Co. He assumes responsibility for design, quality control and manufacturing. He formerly was with Putnam Tool Co.

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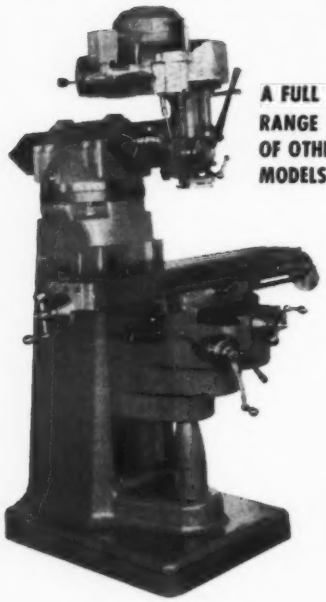
—this NEW "45" INDEX MILL

has the "CALIBER" and "ACCURACY" to do your MILLING, DRILLING and BORING JOBS .. BETTER, FASTER AND MORE ECONOMICALLY!



A FULL RANGE OF OTHER MODELS.

The big caliber derives from the sliding overarm—The unique square design of this overarm gives much more rigidity with its resultant greater accuracy—It provides extra range and capacity—More usable working space—More versatility in set-up—More power at the cutter. No adjustment required on overarm and head after use, and no need to re-indicate head after moving overarm. Speed range with 9 changes makes possible the use of high speed or carbide tipped cutters to the best advantage. Many other important features.

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INDEX MACHINE CO.

541 N. MECHANIC STREET JACKSON, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 130

Three major executive appointments have been announced by Gear Grinding Machine Co. and its subsidiaries. **William F. Wilson** has been named executive vice president of Gear Grinding. **William J. Taylor** is serving as vice president and general manager of Republic Gear Co. The new vice president of Detroit Bevel Gear Co. is **Fred F. Miller.**

◆

Walter R. Bush has become vice president in charge of engineering and a member of the management committee of Fenwal Inc. He will be responsible for all research and applied engineering work on such products as aircraft fire detectors, jet engine controls, industrial thermostats, thermistor controllers and newly-developed process control systems.

◆

Donald M. Berges has been elected vice president of Jack & Heintz, Inc. He will direct activities relating to J&H commercial motors and the development of new product lines and markets. Before joining J&H, he was with Master Electric Co.

◆

Elmer D. Robinson has been named director of manufacturing for Morse Chain Co. He will head all Morse manufacturing, quality control and industrial relations at the Ithaca, N. Y.; Detroit, Mich. and Simcoe, Ontario plants.

◆

John B. Beltz has become assistant chief engineer of the Oldsmobile Division of General Motors Corp. He is in charge of body and sheet metal design and engineering standards. **T. R. Tompkins** has been advanced to the position of experimental engineer.

◆

Yougene J. Lamar has been appointed manager of product planning for the ElectroData Division of Burroughs Corp. He will be responsible for evaluating new ideas in the electronic data processing field, and recommending to management the expansion of present ElectroData product lines and the addition of new ones.

◆

Edward T. Bryand has joined the staff of Portland Copper and Tank Works, Inc. and will serve in the capacity of supervisor of the new products department. In his new position, Mr. Bryand will supervise operations in the new products department, placing emphasis on the commercial and defense aviation work in which the company is engaged.

MEN YOU SHOULD KNOW

Albert S. Burgoyne has been appointed to the newly-created office of vice president in charge of manufacturing of E. W. Bliss Co. He will be in charge of coordinating and directing the activities of the company's 12 manufacturing plants throughout the United States. Mr. Burgoyne formerly was with the Gage Division of Pratt and Whitney Co., Inc.

◆

The election of **Stanley J. Roush** to the newly created position of group vice president of Borg-Warner Corp. has been announced. Several divisions of the corporation will report directly to him. Mr. Roush will also retain his present positions as president of the Atkins Saw Division of Borg-Warner and president of Morse Chain Co., a Borg-Warner subsidiary.

◆

Charles M. Hawkins has been appointed general manager of Ehrhardt Tool & Machine Co., acording to an announcement by **Willis Ehrhardt,** president. Mr. Hawkins joined the firm in 1940.

◆

Ralph A. Purcelli is serving as general manager of the new plant of Rockwell Mfg. Co., in Statesboro, Ga.

◆

Several personnel changes have been made known by Brown & Sharpe Mfg. Co. **Wallace B. Bainton** has assumed new duties as vice president and general manager for machine tools. Aiding Mr. Bainton are **Charles M. Evans,** manufacturing manager; **Harold Sizer,** director of design-machine tools and **Alfred L. Hurst,** assistant to the vice president and general manager. The company's new vice president and general manager for industrial products is **Wallace E. Anderson.**

◆

Richard W. Banfield is succeeding **Charles B. Lansing** as president and chief executive officer of The Motch & Merryweather Machinery Co.

◆

Robert A. Beck has been appointed vice president of City Tool Corp. He is also plant superintendent of the company.

◆

The new vice president of The Barden Corp. is **Thomas E. Rounds. Bruce L. Mims** succeeds Mr. Rounds as chief engineer.

◆

The election of **Rear Admiral Paul E. Pihl,** as chairman of the board of Hupp Aviation Co., a subsidiary of Hupp Corp., has been announced by **Ted V. Purvin,** president of Hupp Aviation.

The Spring Division of Crucible Steel Co. of America has appointed **Thomas A. Carr** as supervisor of metallurgy and quality control. The announcement was made by **T. T. Crowley,** general manager of the division. Mr. Carr has been an employee of the company since 1939.

◆

Calvin R. Depew has taken over as vice president-Staunton Operations for American Safety Razor Corp., according to an announcement by **Sidney Weil,** president.

H. R. Leber has been named vice president of Sundstrand Michigan Corp., a wholly owned subsidiary of Sundstrand Machine Tool Co. In addition to his new duties, Mr. Leber will continue as general sales manager of the company's machine tool division.

◆

The Onsrud Machine Works, Inc. has announced the appointment of **Charles R. Onsrud** as general manager. Mr. Onsrud has been with the company since 1948.

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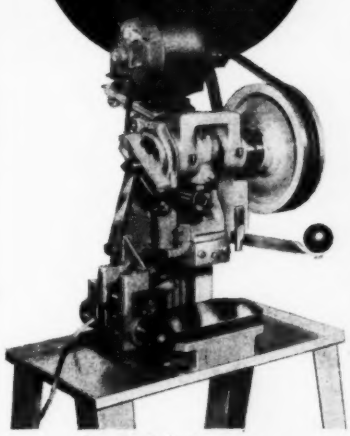
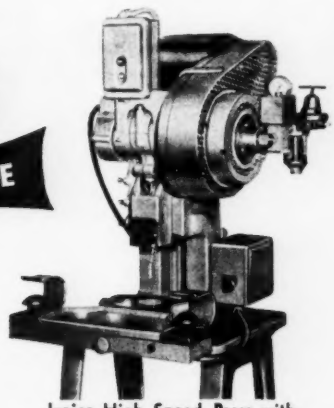


Standard Junior Press



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We also manufacture a full line of O. B. I. presses, blanking presses, straight side single and double crank, transfer presses, deep throat presses, back flywheel presses and many other models for press work of all kinds.

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Investigate this latest advancement in a fast, safe press.

Our standard Junior Inclinable press built since 1929 is available in a variety of frame sizes. We have deep throat presses and high ones too. This is an accurate, well built machine of proven quality and durability. With no advance in price, this press with its low cost is a real "buy" to-day.

Also available — An accurate dependable roll feed. Back geared presses with dial feed attachments. Two hand safety trip attachments.

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MACHINE CO. WARREN, MASS.
PRESS BUILDERS FOR OVER 50 YEARS

CIRCLE INFORM-A-GRAM KEY NO. 131

Gear Tooth Honing Improves Gear Sound Qualities

Three methods have been used in the past with varying amounts of success to improve the sound characteristics of hardened gears. These are grinding, burnishing and lapping. The grinding of gear teeth in the hard state is an expensive and time-consuming process, since only one tooth or space at a time can be ground.

The burnishing process, in which the hardened gears are run in cramp mesh with one or more hardened burnishers, has the major disadvantage of setting up stresses in the hardened gear teeth. Under load, these stresses begin to relieve themselves and the hardened gear teeth tend to regain their original incorrect shape.

The process that has met with the greatest measure of success in improving hard gear sound qualities heretofore has been the lapping process. This method, too, is expensive and hard to control because excessive lapping tends to destroy involute form.

The advent of gear shaving, in which teeth on hobbed or shaped gears could be finished in the soft state with corrections provided for heat treat distortion, has practically eliminated the use of grinding, burnishing or lapping processes on hardened gear teeth. However, the trend of industry to higher speed, more compact gears has stressed again the need for more accurate, quiet, hardened gears. Nicks are still unavoidably produced in soft gear teeth in production lines. And the present method of locating these nicks on sound testing machines and removing them with a pencil grinder leaves much to be desired in the way of minimum tool cost or maximum accuracy.

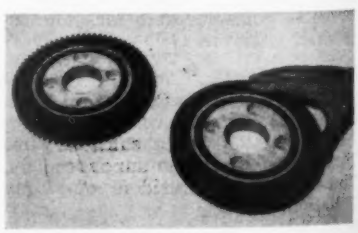
To meet the need for more accurate, quieter, high speed, compact gearing, National Broach & Machine Co. engineers have developed the new Red Ring gear tooth honing process.

This new basic gear production process improves sound qualities of hardened spur or helical gear teeth by removing nicks and burrs; correcting small heat-treatment errors in spacing, profile lead or eccentricity; and improving surface finish. The new method can be economically adapted to both high and low production.

To carry out the tooth honing process, National Broach engineers have developed two initial models of high speed machine tools that operate in conjunction with a unique new gear tooth honing tool.

The honing tool, Figure 1, is essentially an abrasive-impregnated helical gear that is run in mesh with the hardened gear in crossed axes relationship at high speed. The hardened work gear is driven by the honing tool and traversed back and forth across the honing tool in a path parallel to its axis during the honing operation. The work gear is run in both directions during the process. The process is readily adaptable to

Fig. 1. Two Red Ring gear honing tools. The amount of helix angle on the teeth of the abrasive-impregnated tools depends upon the helix angle of the work gear and the amount of crossed axes angular setting.



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gives all the meat of ASA Standard B46.1-1955 on surface roughness, waviness and lay, plus helpful supplementary material. Arranged for easy reading and convenient reference. Includes these sections:

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CIRCLE INFORM-A-GRAM KEY NO. 132

manual, semi- and fully-automatic loading arrangements. The honing tool is a throw-away type that is made to close tolerances and discarded at the end of its useful life.

The honing action of the abrasive-impregnated gear tooth honing tool removes all nicks and burrs in the tooth flanks. The honing process is designed to remove metal up to 0.002" over pins. However, since the honing action tends to accurately generate a tooth form and shape, small corrections in tooth form and lead which will considerably improve the sound characteristics of a hardened gear are made by the process. Surface finishes of fine quality can be readily achieved with the honing process on shaved gears.

Small pinions are rotated at speeds up to 3000 rpm for the honing process. Larger gears are honed at speeds corresponding to about 800 sfpm.

Red Ring gear honing is a hard gear finishing process. Present methods of generating teeth in the soft state should be used. This means hobbing or shaping followed by shaving. Thus maximum uniformity is assured in all soft gears, as well as having suitable form and lead correction allowances made in the teeth before they are heat-treated. This method leaves only the correction of minor form and lead errors up to the honing operation, as well as the removal of any nicks or burrs. By making the most accurate gear teeth possible in the soft state, maximum

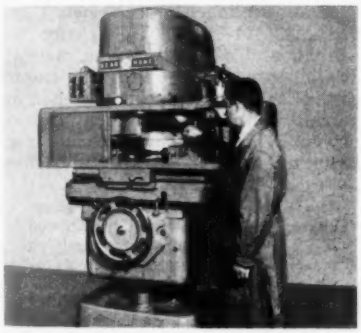


Fig. 2. The new Model GHB Red Ring Gear Hone arranged for manual loading of an automotive transmission helical gear.

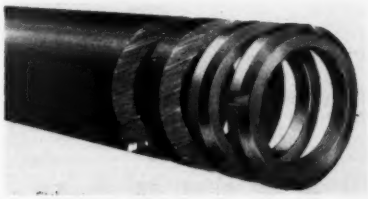
honing tool life is assured and minimum cost and honing time will result.

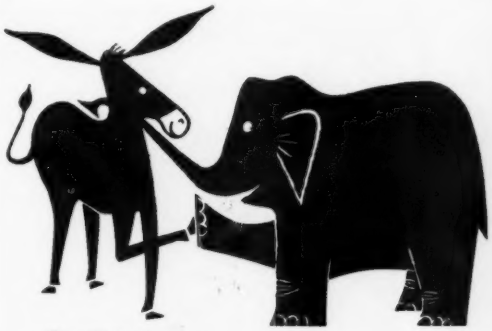
Following the heat treatment process, the hardened gears should have their locating holes and/or faces ground in accordance with the usual practice. Then all gears are put through the honing process to remove nicks and improve sound quality. If sufficient control is exerted in the hobbing, shaving and heat treatment process, it is possible to eliminate the conventional hard gear nick testing operation where nicks and burrs are located for subsequent removal by a pencil grinder.

Special Process Tubing ups Locknut Production 24%

A seamless steel tubing specially processed for easy machinability is responsible for a 24% production increase in threaded locknuts produced by Standard Locknut and Lockwasher, Inc.

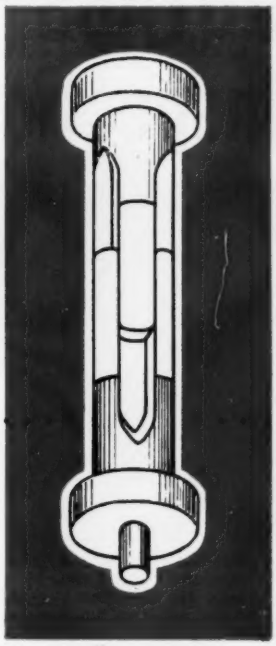
The company, which manufactures a full line of locknuts and lockwashers for ball and roller bearing applications, reported the increased production figures after they had switched to new NP-60 Seamless Steel Tubing produced by Ohio Seamless Tube Division of Copperweld Steel Company, Shelby, Ohio. Standard's products are widely used in electric motors, machine tools, and in automotive, aircraft, farm and construction applications.





On this issue

we're in complete agreement . . .



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CIRCLE INFORM-A-GRAM KEY NO. 133

AIRCRAFT SPARS MILLED ON TRACER CONTROLLED MACHINE

Manufacturing problems in the Aircraft Industry are becoming increasingly complex. Stabilizer and wing skins and spars are, in many cases, milled from solid aluminum slabs and take many different shapes. Machining of these parts thus requires a machine and control combination designed to provide a variety of cuts.

On a typical machine for the milling of wing spars, the cutting head must be capable of moving vertically and horizontally so that both depth of cut and direction can be controlled. In addition, quite often the cut may require a variable angle along its bottom or side surfaces so that the cutter must also be able to twist as it moves through the workpiece.

To effect a solution to these problems, the Aircraft Industries Association, representing all major U. S. aircraft manufacturers, issued in May 1955, its National Aircraft Standard Specification on a milling machine for milling airframe spars, spar caps and similar parts.

In the short time of a little more than one year, the Onsrud Machine Works, Inc., Chicago, designed and completed a totally new machine to meet these specifications . . . the first of a group of machines by order of the U. S. Air Force.

This machine, the electronic tracer controlled Onsrud A-90-24 automatic contour milling machine not only meets specifications but exceeds them in terms of speed and precision. It is a huge 84' milling machine for milling spar beams and parts up to 60' long. A gantry-type carriage houses four cutter motors that together develop over 320 hp, with an available total of 12 different feed motions all under electronic tracer control.

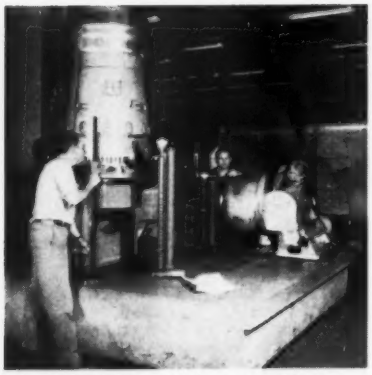
To the Onsrud Machine Works, Inc. and to the General Electric Company who cooperated in the development and application of the electronic equipment go the distinction of designing and producing this first machine of its kind, for universal application in terms of aircraft plants and long-range future production. The machine in effect, with correct tooling, offers a range of dimensions and feeds to meet the production requirements of any aircraft manufacturer for the type of parts for which it is designed, for all present and known future production.

In comparison with all previous spar milling machines, the new Onsrud A-90-24 is 100% heavier in weight, and offers complete manual as well as complete electronic tracer control. The machine is designed to permit doubling of present horsepower loads without overloading structural components of the ma-

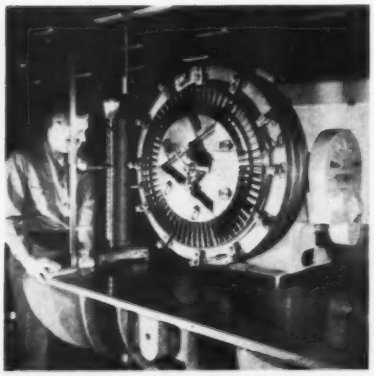
The world's first electronic tracer controlled spar mill . . . the Onsrud A-90-24 universal contour milling machine. Bed length 84' . . . providing work area for parts up to 60' long x 35" wide. Four milling heads mounted on carriage are capable of a total of 12 different head motions, operating singly or in combination . . . in addition to longitudinal feed by carriage travel.

ROTABS Beat Precision Inspection Costs...

This 24" ROTAB plus centering fixture cuts checking time for 11 dimensions on six vane segments from several hours to 5 minutes each.



Checking big jet engine assemblies is fast and simple on ROTABS (36" & 48"), eliminates costly fixtures made obsolete by engineering changes.



Seconds-of-arc precision allows quick, accurate inspection with low cost standard gages. Here 36" powered unit checks vane spacing.

For small parts inspection this 12" universal ROTAB minimizes setup and inspection time, does not require power for tilting and rotation.

For complete data on the optical precision readings you get with the ROTAB at the lowest cost, write:

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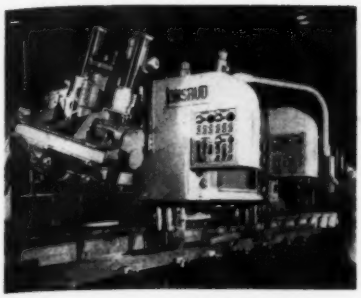


Carriage of Onsrud A-90-24 universal automatic contour milling machine for spar milling. Note angular position of horizontal head. Under electronic tracer control, head can be raised and lowered (vertical feed) in combination with varying of angular position on either side of the vertical plane to produce twist milling cut.

chine. It is designed for today as well as tomorrow, in anticipation of every possible need.

Four milling heads are employed on the machine. All four heads can be operated at one time, or singly, or in any combination. Speeds, feeds and motions are individually controlled for each milling head and a total of 12 different electronically controlled movements or feeds are available, in addition to longitudinal feed. Longitudinal feeds of the cutter heads under full load is from zero to 28 fpm . . . a speed achieved by only a few machines even when under no-load return feeds.

Stud Welding Replaces Bolts Cuts Costs 60%

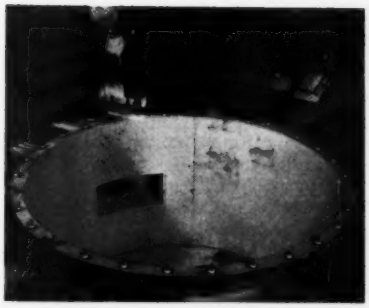
Cost of securing cover plates on commercial dry cleaning machinery has been cut at least 60% through use of stud welding at the Vic Cleaning Machine Co., Minneapolis.

Before Nelson standard threaded studs, products of Nelson Stud Welding Division, Gregory Industries, Inc., Lorain, Ohio, were adopted eight years ago, cover plates were fastened to the welded assemblies by bolts inserted in drill holes to obtain the required accuracy. The bolt heads were hand welded on reverse sides of the base plates.

Besides being inherently much faster, easier, and just as accurate as this former fastening method, stud welding also permits more flexibility and freedom of design. Studs are end welded from only one side of base plates and may be placed in locations where hand welding on the backsides would be difficult if not impossible. Studs are ⅜" dia and either one or two inches long.

Other benefits of stud welding realized by Vic Cleaning include improved appearance and easier maintenance.

Sheet metal templates are used to locate studs accurately at most points. On some applications, however, the actual cover plates have been used to locate center punch marks. The welding generator is centrally located in the shop so that all machinery being assembled may be reached with one stud welding gun.



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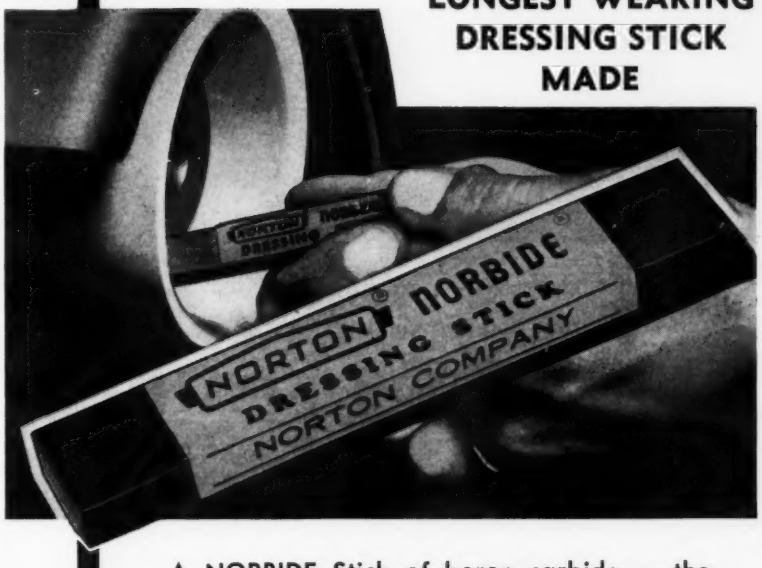

A NORBIDE Stick of boron carbide — the hardest manufactured abrasive commercially available . . . will outlast hundreds of ordinary abrasive sticks . . . greatly reduce dressing dust nuisance too.

A couple of passes with a NORBIDE Dressing Stick is all it takes to clean up a wheel face, dress a radius or groove or touch up a cup or saucer wheel. And — with this conveniently sized stick — you can see more of the wheel and avoid costly overdressing.

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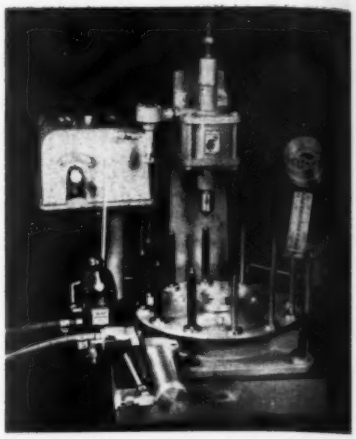
Air Units Mounted on Standard Base Form Special Unit

An air-operated rotary work feeder combines with a pneumatic timer, an air press, and a miniature hopper, to crimp eyelets and rings on the barrels of fountain pens. All units are mounted on a standard Mead "Universal" base to form a semi-automatic machine; the operator merely keeps the hopper and dial loaded.

The pen barrels are held on 12 special studs around the rim of the dial, where they are placed by hand over the eyelet which has dropped on the stud from the hopper. At the work station a single-acting air cylinder with crimping tool attached to ram, presses the components together. This cylinder has an upper ram with threads and lock-nut to stop the down stroke at exactly the right point.

The Meadmatic Timer, a self-contained unit mounted on a post convenient but out of the way, controls the number of cycles per minute and the length of the "dwell". A quick exhaust valve at the cylinder air intake hastens the return stroke to clear the work before the table indexes, and a speed control valve regulates the down stroke of the tool. A midget air cylinder, also deriving its air from the timer, rotates the hopper. Not only was production increased, but quality improved and spoilage reduced. This air powered assembly machine was built by the Mead Specialties Co., Dept. RW-93, 4114 No. Knox Ave., Chicago 41.



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Hydraulic Press Equipped to Stake Assemblies

Dual exhaust tail pipe supports are assembled at the Oldsmobile plant in Lansing, Michigan, on a pressure sensitive hydraulic Denison Multipress, while a shaft is simultaneously assembled in a bushing. Figure 1 shows this setup.

Each assembly consists of two offset stamped arms with a hole punched in each end, a shaft having shoulders on each end, and a bushing assembly consisting of a rubber bushing secured in a metal retainer.

The shafts are hand loaded into a magazine and the bushing assembly is placed on a "V" block directly in line with the magazine. An air cyl-

Fig. 1. Press setup to assemble stirrup-like tail pipe support. An air cylinder, on the bushing assembly fixture, forces a shouldered shaft into a rubber bushing while the press is simultaneously staking both ends of the shaft to offset arms.

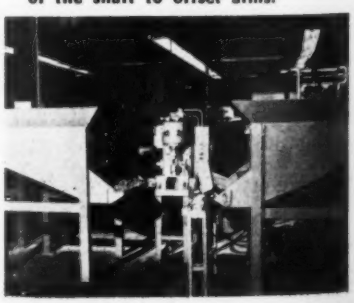


Fig. 2. Close-up of the shaft-to-bushing assembly fixture, showing magazine for shafts, bushings and air cylinder. The fixture is normally actuated by the hydraulic press palm buttons but separate palm buttons are provided for setup.

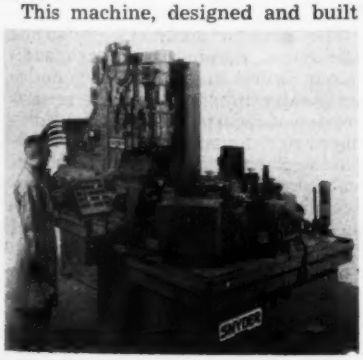
inder on this fixture, Figure 2, which is actuated by the press controls, forces the shaft into the bushing assembly. When the shaft is properly inserted in the bushing, the air cylinder reverses, permitting a new shaft to discharge from the magazine into assembly position. The operator, when removing the bushing and shaft assembly from the fixture, positions a new bushing assembly in the "V" block.

The bushing and shaft assembly is then positioned in the 6-ton hydraulic press fixture with each end of the shaft protruding through a hole in the end of the offset arm. The press and shaft clamping fixture are then energized by the same two palm buttons. As the press stakes each end of the shaft, securing the offset arms to the shaft, the next shaft and bushing assembly operation is being performed. Thus, staking and assembly operations are performed simultaneously.

Special Milling Machine Performs Complex Work

A new milling machine that performs five complex milling operations with minimum tool changes and part handling is a typical example of operation simplification and savings in floor space that can be achieved by incorporating suitable controls and drives in a special machine for low production requirements.

This machine, designed and built by Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, consists basically of a welded steel T-shaped base on which are mounted a 40" dia rotary table and a horizontal slide unit carrying a vertical spindle. Table speed, vertical cutter travel, and horizontal slide travel are controlled by stops mounted on the table periphery. Thus it is possible to provide a variety of cutter locations, interrupt cuts, and change table speeds by suitable stop locations. Cutter speeds are adjusted to tachometer settings by a variable speed drive. Tool changes are simplified by a quick-change collet-type holder. Tool setting gages are built into the work fixture that is mounted on the rotary table.



The machine illustrated mills bosses, and performs four blend-milling operations on a large magnesium aircraft jet engine front bearing support. The cutter is automatically lifted or backed out to clear spokes or interrupt cuts in the various operations. Table speeds are automatically increased for rotation between milling cuts.

The five operations are performed with the part in two different loading positions using three different milling cutters.

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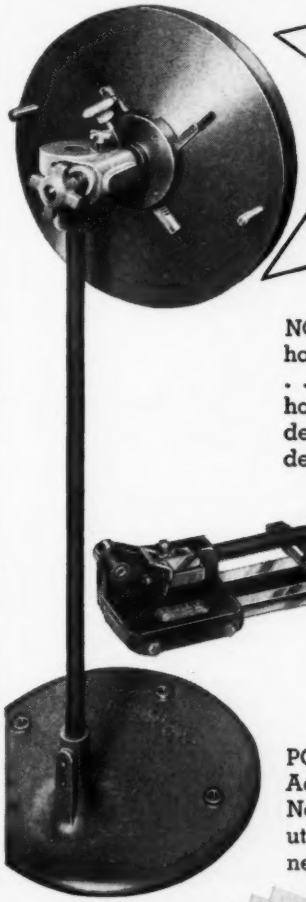

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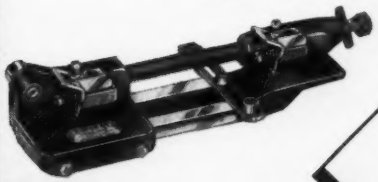

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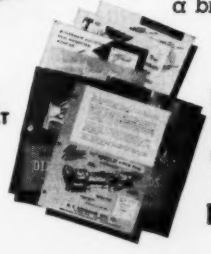

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CIRCLE INFORM-A-GRAM KEY NO. 137

SEVEN MAJOR METHODS FOR FUNDING YOUR PLANT MODERNIZATION PROGRAM

by David L. Salinger

Director Industrial Division

WALTER E. HELLER & COMPANY

Chicago, Illinois

SO YOU'VE DECIDED you'll have to replace outmoded equipment and modernize your plant in the interests of efficiency and lower unit costs. You'll undoubtedly make the wisest choices of what to get and how to make use of it.

But the question still remains: How should it be financed? You look at some of your choices:

1. Purchase out of cash funds.
2. Increasing your capital investment.
3. Short-term bank borrowing.
4. Long-term indebtedness.
5. Making use of credit from the seller.
6. Intermediate-term payments through an industrial financing concern.
7. Lease or rental.

And when you have picked the method that is best for your own particular purposes, what side effects will you need to take into account? For example:

Which of several depreciation formulas will be best for you to follow on the new machines?

What effect will labor-savings have on your cash payroll, net?

What other savings will be effected?

How much increased productivity will result?

Where will you achieve best changes in your pricing and sales policy?

What shifts may have to be made in management and other personnel?

What will be the result in changed financial needs as to payroll, raw materials required, stocking of finished inventory, carrying of increased accounts receivable, and so on?

Editor's note: The plans advanced by Mr. Salinger do not exhaust all ways and means of financing a modernization program. In exploring the subject, your own banker might well be your court of first resort.

And thus, how long will it take the machine, all the foregoing factors considered, to "pay for itself?"

If you need new equipment, you are already paying for it—in payroll, maintenance costs, rejects, slow deliveries, and sales lost to competitors with lower cost-structure. So let's make prompt examination of some possible answers to the questions we've raised about how to modernize.

The first method — purchase out of cash—may be your best move, if cash resources are sufficient to leave a sizable working balance after purchase. Any buying of new equipment which tends to make a serious dent in a company's bank account should be closely scanned. A good cash position is a necessity. Lack of it could make it difficult to meet unexpected emergencies, or have funds available for purchasing supplies and materials, or otherwise putting the new equipment to its best use.

The second method — financing equipment purchases through additional capital investment — is not so frequently used. Acquiring a partner (or, if incorporated, issuing additional stock) sometimes requires surrender of control. Even where control is retained, many business managements find it difficult to condition themselves to a new group of equity holders.

But the basic objection to this method of equipment financing is that it involves permanent capitalization in order to take care of a pe-

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riodic need — with an implied future demand for support of increased dividends that can be most distressing.

The third method (securing a short-term bank loan) has several specific advantages, and some disadvantages. On minor equipment it has much merit, especially where the purchase need not be capitalized and the charge against current income will save enough or nearly enough in tax outlay to enable repayment to the bank.

On major equipment an optimistic assumption is sometimes made that increased profits will more than cover fast repayment. This can work out uncomfortably if payments are too large, or for too short a period.

Where normal interest rates can be arranged (though this is not always easy these days), this type of equipment financing has the additional advantage of fairly low cost.

Further, it can sometimes be placed in the manufacturer's own local bank, where a personal relationship and good understanding already exist. If such a business has an abundant line available at the bank, this may be a prudent election of method.

If the firm does not have that good position, however, it should carefully consider the facts. In obtaining such a loan from its bank, it may tie up its total available credit to an extent that may later be extremely cramping. *Things can happen for which an immediate unsecured loan is needed, and the loan be not forthcoming because of the existence of the previous equipment loan.*

The fourth method is the use of long-term borrowings. Maturity may run up to say 10 years—usually not more than that. Such loans are generally amortized annually, and evidenced by notes or debentures of one type or another.

The terms of the loan are generally embodied in a loan agreement, which may require, for example, that the borrower:

Maintain excess working capital at a specified minimum amount or ratio;

Furnish certified financial statements periodically;

Provide assurance with each statement that he is not in default in any of his obligations;

Refrain from doing certain things, such as paying dividends or purchasing or redeeming the capital stock of his firm; entering into any merger or consolidation; creating mortgages against any of the firm's assets; borrowing money except as provided in the agreement; making capital improvements in excess of a specified amount; selling receivables.

An advantage of the long-term loan is sometimes a fairly low coupon or interest rate. Prepayment, however, is generally difficult without penalty and modifications to permit, for example, additional borrowings which can be hard to negotiate, and long-drawn-out. Particularly for moderate-sized issues, the fixed costs of arranging and placing the loan, when considered together with the percentage interest rate, may bring the total cost up to a point where it is more advantageous to arrange other types of borrowing.

Thus the long-term loan is a relatively inflexible method, that may work a hardship on a manufacturer who (like most small and middle-sized companies) finds it difficult to chart out absolutely his requirements over a long period of years. Further, the borrower is apt to find himself either over-borrowed or under-borrowed at most times during the life of the loan, depending on seasonal and year-to-year fluctuations.

The fifth method—using the credit of the seller—was feasible when manufacturers or distributors made a practice of deliberately encouraging the offering of terms, and used their own working capital to carry the resulting customer obligations. Under today's tight credit and money conditions, however, this is in-

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creasingly rare.

If a supplier is asked for terms that he is reluctant to give, the buyer may suffer certain disadvantages in price, delivery date, and status. Recognizing the legitimate need, however, for such credit extension, many sellers have arranged for the services and funds of one or another of the industrial financing companies, for their own and their customers' benefit.

The last mentioned major method of financing needed equipment is through the use of an intermediate-term arrangement through an industrial financing company. It is nothing particularly new, having been fairly widely practiced during the last 30 years and more. It has come into increasing use since the war, and is today standard operating procedure in such industries, for example, as construction and earth-moving machinery, materials-handling equipment, certain metalworking fields, and others.

A disadvantage of this method over some of the others is its relatively high cost, if stated in terms of percentage of interest per annum. Most companies using this method, however, find this more than compensated for by substantial other advantages.

These include specifically:

1. Great flexibility in amount of advance deposit (or "down payment") and length of term-factors which can be adapted to the necessities or preferences of each individual purchaser, and to the projected earning power of his new equipment;

2. Privilege of prepayment without penalties if earnings prove greater than expected; (Reasonable extensions, too, are usually easily accomplished if earnings lag or unforeseen alterations are called for in production programs.)

3. The purchaser's obligation is not callable; only the current year's portion is shown as a current liability;

4. Bank-lines are left undepleted; and (perhaps most important of all)

5. The amount and length-of-term of credit extended is based not only on the buyer's balance sheet and character, but also on the additional earning capacity which the resulting modernized plant will make possible.

Whether you lease, rather than buy, involves a whole series of tax and other considerations. It may put you between the proverbial "devil and the deep blue sea." In this case, it may be the "devil" of leasing (without ever building up an equity) on the one hand; and on the other, the "deep" of disallowed tax deductions (if you achieve ownership by arranging that rentals apply liberally to the purchase price). The subject is an intricate and shifty one, but, if you do lease, you will, in any case, want rentals to have some relationship to benefits derived from use of the leased equipment.

Basic therefore, to your equipment financing is a realistic idea of how fast you can and should pay for the machine.

You cannot apply a strait jacket to your thinking, or take somebody else's dictum that, for example, the orthodox figure must be 25% down and the balance in 12 monthly payments — or any other figures. For your competitor a cash down payment of half the price of the machine may be quite feasible; and, of course, to the extent that this does not deplete working capital, you say "Fine . . . the larger the down payment, the smaller the subsequent monthly payments, and the fewer the dollars of financing cost." You may prefer, though, to make a more moderate initial investment.

In any case, the balance after the initial payment should not be more than you would be willing to pay for the unit if offered you elsewhere as used equipment.

This balance should be divided into as many payments as necessary to bring each payment within the user's abilities to meet it—and without agonies. The resulting term is too long, and you will be penalizing yourself, if at any time your unit

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CIRCLE INFORM-A-GRAM KEY NO. 140

would not comfortably bring—under the hammer, if need be—at least the balance remaining unpaid on it.

A number of types of equipment produce their heaviest likely revenues for the user during the earliest years of their use. This is generally because:

1. Machinery tends to be most efficient and profitable in its earliest years, when maintenance costs are lowest;

2. A new model machine is likely to be at an advanced stage in technology and hence in cost savings;

3. The prospective user is, sometimes, most certain of a heavy pay load for his machine in the period immediately following its acquisition (that's often why he is buying it); and

4. Permissible depreciation charges can now be higher, and thus the tax base lower, in the first part of the life of a new piece of equipment.

By scaling payments more heavily in the earlier years, and lightening them in the later years, total dollar cost to the user is reduced substantially; he can be allowed greater freedom as to down payment and over-all length of term; and he may more nearly achieve the ideal situation of letting his equipment pay for itself out of earnings—a true "pay-as-you-earn" plan.

A limitation of intermediate-term equipment financing is the fact that, for most companies, the facilities for acquiring a piece of equipment, over a period of one to three years or even longer, are only part of the answer to their problems.

Some industrial financing companies, recognizing this, offer a variety of services to make it possible for the equipment user to work out *a complete financial management program at the same time that he plans to acquire his modern equipment.*

For example, your new installation may increase your production by 50%, and your sales proportionately. If you were carrying, as a result, accounts receivable of $100,000 before, you will need to be able to accommodate $150,000 now. The factoring or outright sale of these accounts may be the answer for you—or, if not factoring, then possibly a direct borrowing against them. In either case, you receive cash — the amount of which is directly keyed to your month-to-month sales volume—and you are neither over-borrowed or under-borrowed.

But increased receivables are only one result of your increased volume. You may find that raw materials acquisition, and the carrying of increased inventory, are more under the new conditions than you can comfortably manage. Thus an inventory loan (generally with the support of a field warehousing arrangement) may be called for. Some industrial finance companies will also handle this, along with their other services.

It may even become necessary, if your business has been greatly increased and is still growing rapidly, to supplement the foregoing methods with further loans. These can sometimes be made by your industrial financing company, based on plant equipment which you already have, and which is free and clear and thus available as security.

Other problems mentioned above —such as the need for additional management people to take care of the increased scope of your operation, re-pricing, changes in your labor force, and so on—your financing organization can not directly assist you with, other than, often-times, by sound advice born of a broad experience with many companies in similar situations over many up-and-down years. One specific thing they can, and often will undertake is an installment sales and rental financing program as a sales-booster for your own expanded production, provided of course that your product is of a nature that lends itself properly to that sort of treatment.

How to Straighten Flap Tracks

Precision parts for aircraft call for the use of precision equipment.

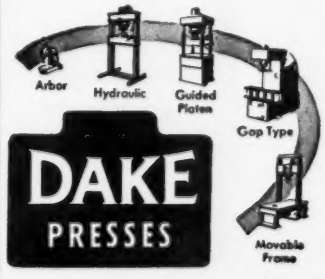
These flap tracks, machined from 4130 steel (aircraft quality), must be checked on a straightening press four times during fabrication. For ease of control and accuracy, the work is done on Dake Gap Type Presses like that shown in the photograph above.

To the right of the ram, the operator has placed a rule gauge which indicates ram travel. Knowing the elasticity of the piece being tested, he can estimate the overtravel necessary to straighten the piece with a single movement of the ram.

Dake Gap Type Press broaches boring bars

Dake Gap Type Presses are available for straightening or forcing, in 22 models ranging up to 300 tons capacity. They are fully described in Bulletin No. 299—sent on request.

Dake Corporation, 634 Seventh St., Grand Haven, Mich.



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CIRCLE INFORM-A-GRAM KEY NO. 141

PUNCH AND DIE DESIGN FOR LAMINATED PLASTICS

by E. C. Graesser

Chief Engineer of Quality Control and Application Engineering

NATIONAL VULCANIZED FIBRE COMPANY

Wilmington, Delaware

PRECISION PUNCHED PARTS from laminated plastics are finding increasing applications in the electrical and electronic industries, such as in printed circuitry, electric motors, electronic controls, and numerous components of radio or television sets. In the manufacture of such parts, punching is generally done with standard power-driven presses. Certain basic principles of punch and die design, however, should be carefully followed to insure optimum production rates and required precision in the punching operation.

In this article, basic factors to be considered are reviewed and discussed briefly as a guide to tool and die designers. Approximate dimensional correction factors for proper die design are given and their use is explained by means of a specific example with illustration.

Basic Factors to Consider

Basic factors to be considered in punching of laminates include:

- Thickness of the stock
- Grade of the material
- Size and proportions of the finished piece
- Quantities to be produced
- Whether grade used is best punched by cold or hot punching methods
- Dimensional tolerances required

Thickness of Stock. Some laminated plastic punching grades can be punched cold in thicknesses up to $\frac{3}{32}$". Harder grades require heating in thicknesses from $\frac{1}{32}$" and up.

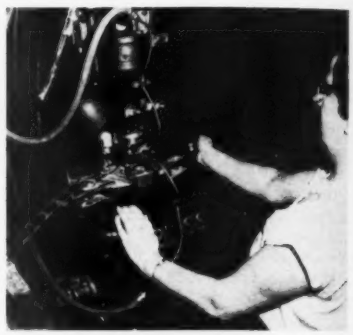
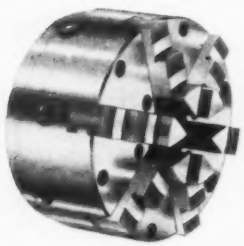


Fig. 1. Cold punching parts from paper-base laminated strip with a compound tool steel die.

Grade of Material. Phenolite laminated plastics produced by National Vulcanized Fibre Company are available in more than 40 different grades — each with a different set of electrical and mechanical properties. The group, in general, is composed of various combinations of fibrous materials — such as paper, cotton, fabric, nylon, asbestos, or glass fabric — impregnated with phenolic, melamine, or silicone thermosetting resins. The tool and die designer, therefore, must know the grade of material to be punched, so that he can design the die accordingly.

Size and Proportions. The factor of size and proportions of the piece being manufactured influences the basic punch and die design. In good punching practice the edges of the piece should not be closer to the edge of the strip than twice the thickness of the sheet. The hole should not be smaller in diameter than the thickness of the sheet, and the distance between holes (or between holes and the edge of the piece) should not be less than the thickness of the sheet.

Chuck with Buck for Precision Production, Less Down-Time



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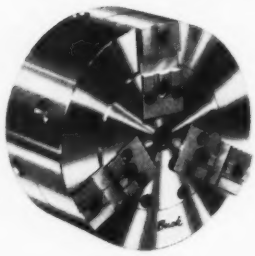
First precision scroll chuck guarantees .0005" precision on duplicate parts without adjustment. 3 and 6 jaws. Sizes from 4" to 12".



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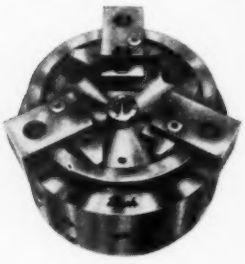

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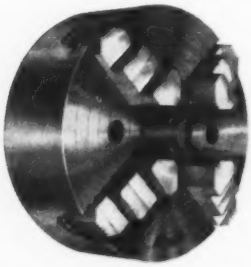
Drives work between centers and, for the first time, ends internal friction and pressure that often distorts work or breaks centers. 6" to 12".



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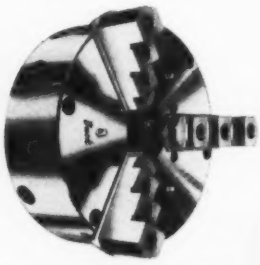

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Quantity of Run. Construction of the die depends upon the quantity of parts being produced. For example, a less expensive, thinner die might well be designed for a "one shot" run of, say, 5,000 pcs, whereas, a heavier die would logically be designed for continuous production of large quantities of the part. Cross-section of the die must be made strong enough to insure economical die life.

Cold vs. Hot Punching. Some grades of Phenolite can be satisfactorily punched cold and there are growing fields of application for these, particularly for copper clad printed circuits. Here, automatic assembly operations, require close registration of punched mounting holes for component inserters, and punching at room temperatures assures precise dimensions of holes and hole spacing.

Especially in the automation of processes involving larger boards for printed circuits (as may be used in computers, for example), precise spacing of punched holes is imperative. Until recently, certain electrical grades of laminated plastic could only be hot punched, but heating of the laminate made it difficult to hold dimensional tolerances. Expansion of the heated sheet along its length may differ from expansion across its width and varies with the material involved. A cold punching laminate, such as National's Grade XXXP-470 Phenolite, is a practical solution to this problem.

In certain cases electrical or mechanical requirements dictate the use of hot punching laminates. The degree of heat used for punching depends entirely upon the thickness and grade of the material. Often, 200°F is a high enough temperature, but in some cases, up to 275°F is required. Heat can be applied to either the material or the dies. Methods of heating include steam plates, electric plates, infra-red lamps, or ovens. When the desired temperature is reached, the material is punched immediately.

Determining Punch and Die Dimensions. All laminated plastics expand when heated. When punching is done at elevated temperatures, the blanks shrink as they cool to room temperature. This would seem to indicate that the blank would be smaller than the die, but this is not true because all Phenolite yields when punched.

Yielding causes the blank to **increase** in size, and by an amount more than it shrinks due to thermal expansion. Thus, a blanking die for hot punching is **smaller** by the amount shown in Table I.

In the case of cold punching, the only effect is that of yielding. The die size is even smaller than with hot punching, because there is no thermal contraction.

Table I. APPROXIMATE DIMENSIONAL CORRECTION FACTORS FOR PROPER DIE DESIGN

(For paper and cotton fabric base grades of Phenolite)

Material Thickness	FOR BLANKING Die Size Smaller		FOR PIERCING Punch Size Larger	
	Cold Punched	Hot Punched	Cold Punched	Hot Punched
1/32 in.	0.002 in.	0.000 in.	0.002 in.	0.003 in.
1/16	0.004	0.0015	0.004	0.007
3/32	0.004	0.0015	0.0065	0.010
1/8	0.004	0.0015	0.009	0.012
3/16	0.004	0.0015	0.015	0.016

Notes: 1. To obtain best results, clearance between punch and die should be kept to a minimum (0.001" max) and the die kept sharp.

2. For hot punching at approximately 225° F, a factor of about 0.002" should be allowed for each inch of length. This factor, which compensates for thermal expansion, should be used in calculating both center-to-center distances between punched holes and over-all length.

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● It doesn't take weeks and months to have this press brake delivered. Standard Verson Model 1062 Press Brakes are in stock. You can get them right off the shelf! Just pick up your phone and order.

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Similarly, due to the effects of shrinkage and yielding, a piercing punch must be sized larger as indicated in Table I. In summary, varying with thickness in stock and method of punching (hot or cold), dies are smaller for blanking and punches are larger for piercing. The values given in Table I are sufficiently accurate to produce parts with tolerances of ±0.003" for paper and cotton fabric base grades of Phenolite.

Use of Dimensional Correction Factors

To indicate the usefulness of Table I, blanking die and piercing punch sizes will be determined for a 1.000" OD washer with a 0.250" hole. The material thickness is ⅛" and hot punching will be employed. Details of the design are indicated in the sketch, Figure 3.

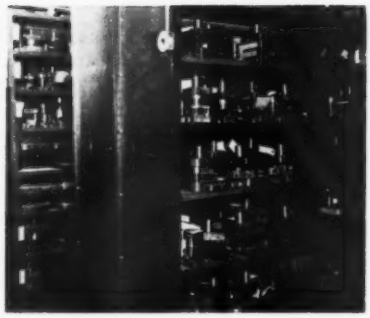

Fig. 2. Shown here are a number of the several thousand tools and dies used by National Vulcanized Fibre Co. in fabricating customers' parts.

(a) Blanking Die and Punch Diameters

1.000 OD of part
—0.0015 factor from Table I

0.9985 dia of blanking die
—0.0010 maximum die clearance

0.9975 dia of blanking punch

(b) Piercing Die and Punch Diameters

0.250 ID of part
+0.012 factor from Table I

0.262 dia of piercing punch
+0.001 maximum die clearance

0.263 dia of piercing die

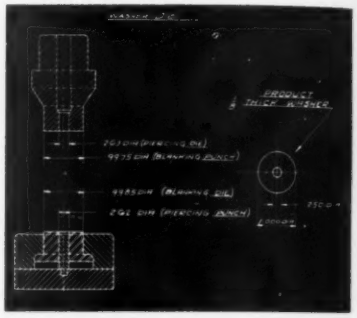

Fig. 3. Diagram showing tool and die dimensions calculated to punch a 1.000" dia washer with 0.250" hole.

Sufficient experience has been gained to prove beyond a doubt that plastics provide certain advantages when used properly. Either hot or cold punching operations for laminated plastics produce precision parts if all basic factors are considered.

HEVI DUTY TOOL ROOM COMBINATION
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This low cost combination consists of the "TEMPERITE" Air Draw Tempering Furnace, maximum temperature 1350° F.; "TREET-ALL" Multi-purpose Furnace, maximum 1850° F.; "SPEED TREET" High Temperature Furnace, maximum 2600° F.; and an "ATMO-GEN" atmosphere generator used to supply a protective atmosphere to the above furnaces. Furnaces and "Atmo-Gen" are available separately. Send for Bulletin HD 1147.

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Is It Compact?
Is It Newsy?
Is It Latest in the Land?

Full Details on Page 36

STRONG AUTO PARTS RADIALLY FORMED NOW AT CHRYSLER

When Chrysler and Cyril Bath engineers collaborated to find a way to utilize the principles of radial draw forming for passenger car part production, they also brought high speed and automation to the Bath radial draw forming process.

For the past 10 years the process has been utilized for aircraft production. Chrysler plans on using newly-designed draw formers to produce body trim, roof sections, and other components.

Two Bath trim-forming machines are now installed at the Eight Mile plant in Detroit and four larger machines, designed to shape the heavy structural drip moldings, will be installed soon. Four additional machines, not yet completed, will produce door pillars, quarter panel pillars, corner strainers, trunk drain troughs and similarly curved parts. The two small trim machines are producing over 700 pcs/hr, compared to 200 pcs/hr by older methods.

"The new machines greatly increased the accuracy of the finished part — up to 1/64" in both cross section and contour," according to Cyril Bath, president of the Bath Company. "This factor of accuracy, while not as vital in automotive construction as in aircraft production, can pay off in an important fashion because of the increased ease and speed of assembly and completeness of sealing against the weather."

The four molding formers grew out of Chrysler's need to compensate for the elimination of the center posts in the hardtop convertible and the advent of the wrap-around windshield, by strengthening the roof. Production engineers had no ready means of forming such complex parts.

The Bath Company first formed this piece on its conventional radial draw former, which stretches the metal beyond its yield point and then wraps it about a die which is bolted to a rotary table, thus forming a piece "a line at a time." Finally, but as a part of the integrated operation, the new shape was "ironed" into the piece through the operation of the compression shoe.

This process proved effective, but too slow for the automotive industry. The high speed automatic drip-molding machines were therefore developed.

Externally, the new draw formers do not resemble the conventional Bath machines. They feature automatic loading, automatic cycling and automatic ejecting — all at very high speed.

The piece to be formed is fed into the machine, where the ends are gripped by gripper heads attached to hydraulic stretch cylinders, and are then stretched under a pull of six tons. Two die elements are then rocked into each other under a pressure of 4½ tons and the piece is completely formed. The piece is then ejected, a new piece fed to the gripper jaws, and the cycle begins again.

"We are convinced," says Mr. Bath, "that with these new automatic high production tools, radial draw forming enters competitively the field of the conventional stamping press, which has been the backbone of the automotive industry for more than a generation."

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Liquid Wicking Replaces Hand Inserted Wicks

Until now, the system for metering lubricant to sleeve bearings has been the use of die cut felts and wool and cotton wastes.

These materials and their companion parts are complex in both shape and application and must be skillfully inserted by hand. In most instances, this assembly of parts and subsequent lubrication requires as many as four individual operations.

Through the development of Permawick — a combination of highly refined turbine quality mineral oil and cellulose base fibers chemically blended — a single, self-wicking, liquid lubricant has been formed.

Because Permawick is a fluid, it flows and completely fills any size sleeve bearing cavity regardless of shape.

Because Permawick will not separate under injection pressure, it represents the only practical process of inserting both wicking material and lubricant — automatically — in one single operation.

The Permajector has been developed for automatically injecting—in two seconds — a precise quantity of

Permawick into any type sleeve bearing cavity. It can be used at almost any stage of the manufacturing process. In its operation a dial is set for the required amount of Permawick and the Permajector accurately meters each injection within ½%.

For further information on these two new products write Fluidwick Co., 5319 East Outer Dr., Detroit 34, or **Circle Inform-A-Gram No. D1.**

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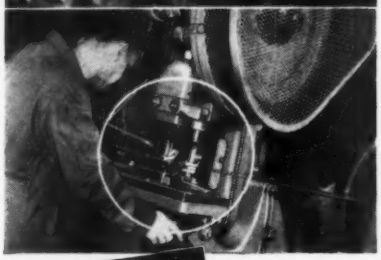
LEADER PIN OILERS



Eliminate wear on your die sets with these leader pin oilers. Acro Pin Oilers, as illustrated, fit over each leader pin and seals in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Eliminate bushing wear, leader pin scoring, and maintain die accuracy. Die sets equipped with Acro Pin Oilers have run under tests for several weeks to a month without refilling.

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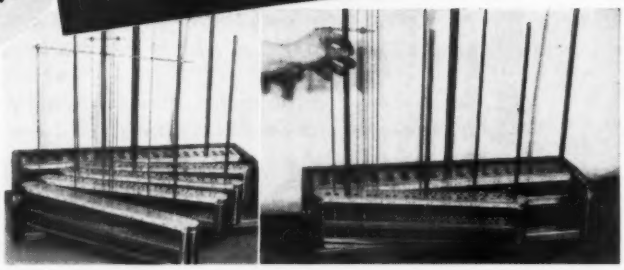

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Also available in half size with fractions or numbers.

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0.0001" Accuracy Feature of New Measuring Scale

The EMscale, a precise measuring scale or rule with an accuracy of 0.0001" or better, has been announced by Elliott-Myers Corp., 96 Hammond Rd., Warren, Pa. It is designed for mounting on machine tools.

The linear scale, which is sub-divided into 0.001" increments, is viewed through a microscope that makes it as easy to read as a standard mechanics rule. Two sets of numbers are always in view so that correct direction of movement is indicated.

By using a microscope incorporating a vernier eyepiece, as shown in the photo, the 0.001" increments are divided into tenths, making possible direct readings to ten-thousandths

of an inch over the entire scale. The scale is accurate not only from end to end but between any two points along its length. By using two microscopes, spaced the length of the scale apart, which are then self-checking, it is possible to double the length of measurement with the same accuracy.

These scales can be fixed to a moving part, and the microscope be a stationary one, or vice versa. They can be used on almost any type of machine such as vertical milling machines, horizontal borers, etc., and as a checking means for any device that is suspected of error. In addition, EMscales are readily adapted for recording accurate linear movement or positioning.

Circle Inform-A-Gram No. D2.

Induction Heating Introduced in New Heat Treating Unit

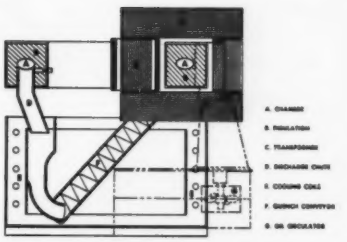
An entirely new, radically different type of heat treating furnace has been designed for carbonitriding, bright hardening, and carburizing of small parts.

In this furnace, the Lindberg Induct-O-Ring, the induction heating principle has been used for the first time in a heat treating furnace. This makes possible the complete elimination of any heating elements, element terminals, burners, gas or electric connections within the furnace.

The Induct-O-Ring also eliminates the usual heat and atmosphere losses occasioned when conventional furnace doors are opened to charge and remove the work load.

Lindberg engineers state that a primary advantage of this furnace is its overall high heating efficiency and its spectacular heating rate, hardening temperatures being reached in 17 min from cold.

The operation of the furnace is automatic and extremely simple. It has a reciprocating motion, turning slowly in the direction of work travel, then quickly reverses. With each action the work remains in the forward position and regularly progresses through the chamber until it reaches a discharge chute. This motion also is utilized to feed a work load into the furnace from various types of hoppers available.



The circular shape provides a great saving in floor space. By using a double turn on the retort, it is possible to have 30' of furnace length in a 5' dia space. Practically any chamber length within reason can be obtained by increasing the number of turns. The Induct-O-Ring is a completely self-contained unit, with quench tank, conveyor and cooling coils enclosed in the base. Only air and power connections are required.

Complete information is available from Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, or — **Circle Inform-A-Gram No. D3.**

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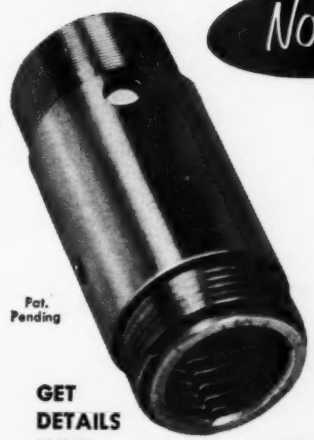

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Start heat treating high speed and carbon steels while other furnaces warm up. Powerful burners in this efficient furnace get heat up to 1300°-2350° F. range in minutes. Temperatures accurately and quickly regulated. Ratchet-operated door opens upward — no need to open fully every time. High temperature refractory-lined firebox keeps heat uniform — 7" by 13" by 16½". 200,000 BTU's per hr. Carbofrax hearth, G.E. Motor and Johnson Blower included ..... F.O.B. Factory, $337.00

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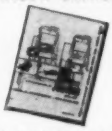

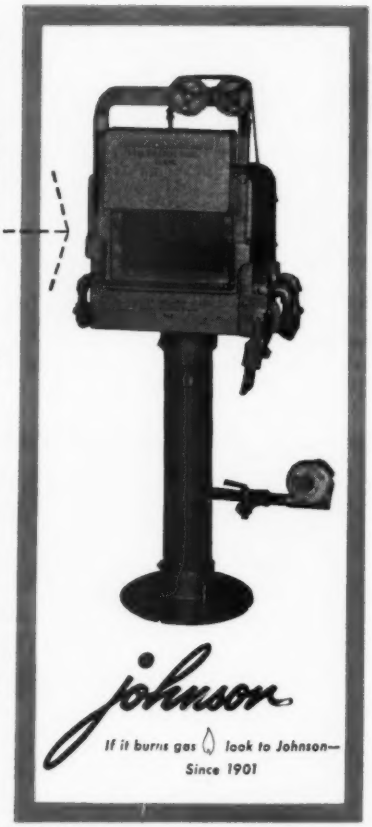

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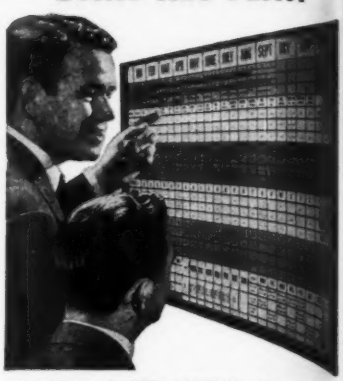

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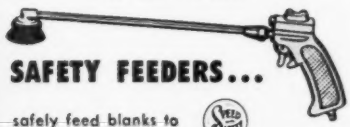

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Save those fingers.

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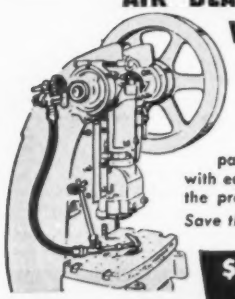

eject parts safely with each stroke of the press—BY AIR!

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handle sheets of steel glass, plywood, boxes, cabinets, etc. Safely—

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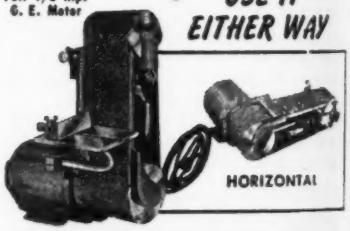

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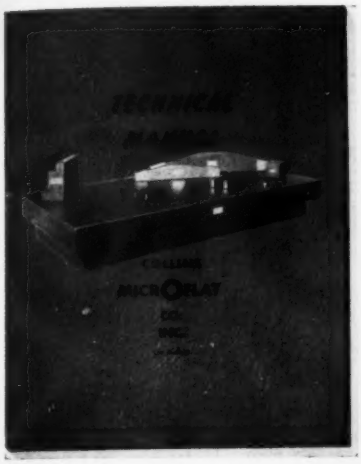
SHOP AIDS

A New Technical Manual on Granite Surface Plates has been announced by Collins Microflat Co., 2326 E. 8th St., Los Angeles 21. It tells how granite surface plates are made, how they are lapped down to



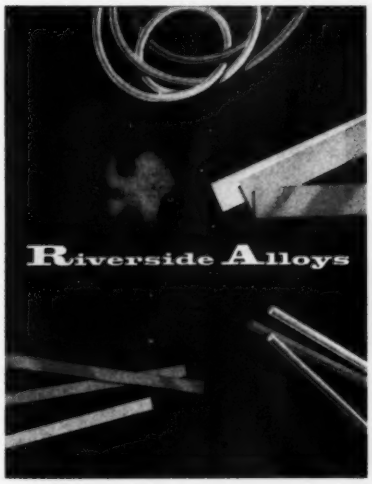
fifty-millionths overall accuracy, and how this accuracy is guaranteed by auto-collimator inspection. Copies of the illustrated 78-page manual are made available by the company, or — **Circle No. C1.**

A Tabulation of non-standard, wrought copper base alloys has been prepared by Copper & Brass Research Association, 420 Lexington Ave., New York 17. The list provides the trade and generic names, nominal composition, forms available, typical applications and mill source for each alloy. This is the first compilation of special copper alloys ever made by the brass mill industry. **Inform-A-Gram No. C2.**

Selection and Engineering Data are included in the precision ball bearing catalog recently issued by The Barden Corp., Danbury, Conn. This catalog contains a dimensional index, a series index and a visual guide to bearing types, characteristics and applications. Pertinent information is presented on page spreads illustrated by cutaways and cross sections. The catalog contains dimensions, descriptions, specifications and complete torque, static and dynamic data in chart and table form, covering standard and special design gyro bearings. **Circle No. C3.**

High Temperature Lubrication with Colloidal Dispersions is detailed in a new bulletin. Presented are many brief case histories, applications and methods for increasing die life and obtaining better finish at less cost. Also given are recommended procedures for using 'dag' dispersions in die-casting and permanent-mold casting. For copies of Bulletin 423, contact Acheson Colloids Co., Div'n of Acheson Industries, Inc., Port Huron, Mich., or — **Circle Inform-A-Gram No. C4.**

Phosphor Bronze, Nickel Silver, Beryllium Copper and Cupro Nickel are discussed complete with applications and specifications in a 35-page booklet. In addition, the booklet contains definitions and engineering



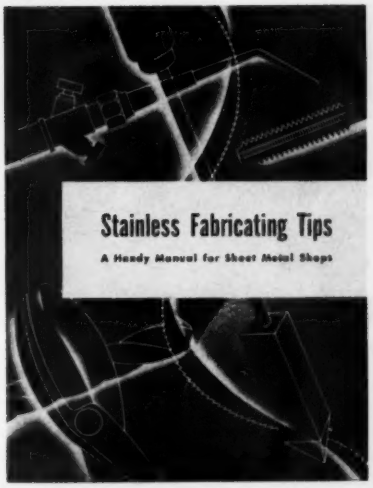
data such as temper, decimal and gauge number equivalents, and the weights of sheet, rod and wire. Write to The Riverside Metal Co., Div'n of H. K. Porter Co., Inc., Riverside, N. J., for your copy of the booklet, or — **Circle No. C5.**

"Power Press Brake Dies" illustrates and describes the dies in most common use. The dies are grouped for quick reference, primarily by the type of bend involved. Included are special purpose dies, ordering information and easy-to-use tables. Also given is supplementary information on sheet, strip and plate gauges, and weights. For a copy of this manual, Form D-955, write to The Cyril Bath Co., 32380 Aurora Rd., Solon, O., or — **Circle No. C6.**

A Color Code Chart for aluminum rod, bar and wire alloys has been released by Kaiser Aluminum & Chemical Corp., Consumer Service Div'n, Room 1156, 1924 Broadway, Oakland 12, Calif. Listed are 32 alloys and their respective color codes which were recently adopted by the Aluminum Association. The chart also shows Kaiser Aluminum color coding for identification tags on wire alloys. **Inform-A-Gram No. C7.**

"Platings on Screw Threads" is designed to help the gage designer and the inspector to tell what allowance to make on before-plate gages. The proper gage dimensions can be determined depending on the thickness of the plating to be applied to piece parts. The bulletin is complete with references to specific sections of H-28 Federal Screw Thread Standards and its 1950 Supplement, plus illustrative charts. Request copies of the bulletin from Size Control Co., 2500 W. Washington Blvd., Chicago 12, or — **Inform-A-Gram No. C8.**

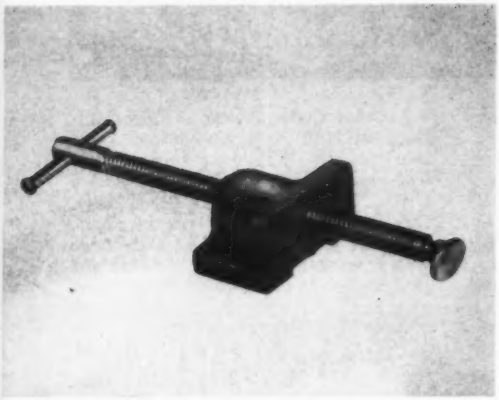
"Stainless Fabricating Tips" details the fabrication of stainless steel in sheet metal shops. The illustrated manual covers forming, cutting, drilling and tapping, welding, riveting and soft soldering. Information is



also presented on silver brazing, surface finishing and cleaning. In addition, gage and weight tables are included. Armco Steel Corp., Middletown, O., will supply copies of the manual, or — **Circle No. C9.**

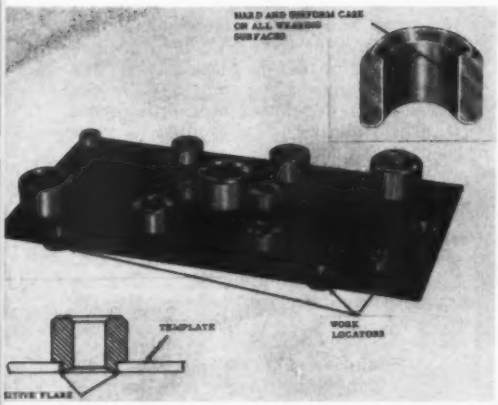
PRODUCTS

NEW DEVELOPMENTS · IMPROVEMENTS · COST AND TIME SAVERS



FIXTURE LOCK . . .

Speedy, simplified clamping jobs are possible with the Rapid Titan Fixture Lock. The inexpensive jig and fixture device features automatic clamping and release, and positive screw tightening. It has a 6¼″ travel. Wilton Tool Mfg. Co., Inc., Schiller Park, Ill., or — **Circle No. A1.**



DRILL BUSHING . . .

Designed to reduce tooling costs is the Flar-A-Lock drill bushing. It is easily installed in light gauge template material with only a hammer and a hand flaring tool. The bushing covers all standard drill sizes from No. 54 to ½″ dia. Techno-Products Corp., 143 Netherwood Dr., Springfield, Pa., or — **Circle No. A2.**

CONTOUR TRACING ATTACHMENT . . .

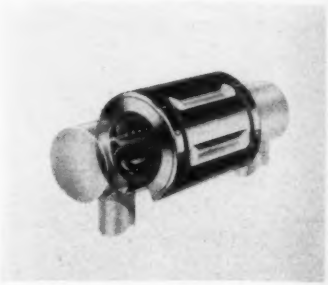
Capable of heavy metal removal in the contour turning and facing of both average and large size workpieces is this hydraulic contour tracing attachment. It provides precise control of successive roughing, semi-finish and finish cuts, using a flat or round template. The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, or — **Circle No. A3.**

BENDER . . .

Multiform "Big Brother" Bender, Model BB-CS, can be equipped for many operations for metal fabricating, stamping, blanking, staking and piercing. This hydraulic unit features 25-ton bending power and a six sec automatic production cycle. J. A. Richards Co., Kalamazoo, Mich., or — **Inform-A-Gram No. A4.**

LINEAR BALL BEARING . . .

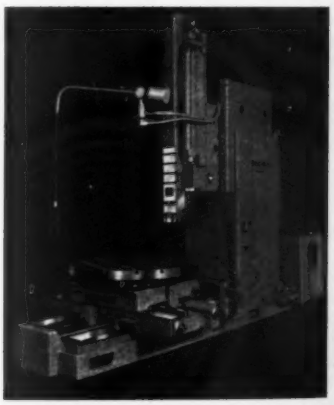
This linear ball bearing permits the use of shaft support members along the length of the shaft traversed by the bearings. Known as Open Type Ball Bushing, it is recommended where extreme or unusually long shafts



are a requirement. Its open construction permits adjustment of its bore diameter by use of set screws or other clamping arrangements. The ball bearing is manufactured to standard dimensions for shaft diameters ranging from 1″ to 4″. Thomson Industries, Inc., Manhasset, N. Y., or — **Circle Inform-A-Gram A5.**

SLOTTER . . .

Accurate and rapid machining of all metals is performed by Hy-Draulic Model SM Slotter. This heavy-duty, 36″-48″ stroke machine features two-speed traverse, enabling the positioning of



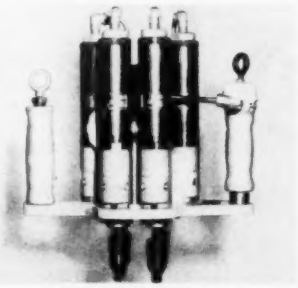
work to a few thousandths, without manual movements. It is equipped with a built-in dividing head arranged for power operation and push button controls. For details, contact Rockford Machine Tool Co., Rockford, Ill., or **Circle Inform-A-Gram No. A6.**

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

MULTIPLE SCREWDRIVERS AND NUT SETTERS . . .

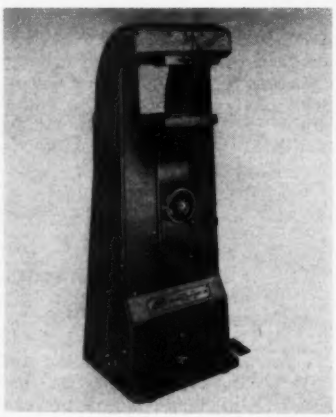
Designed specifically for torques less than 11 foot-pounds are these multiple screwdrivers and nut setters. They are not conventional single-tool units adapted to multiple unit applications, but complete new designs.



These units are easily mounted and unmounted, disassembled and reassembled. Tool speeds range from 225 to 2800 rpm. Keller Tool Div'n, Gardner-Denver Co., Grand Haven, Mich., or — **Circle Inform-A-Gram No. A7.**

MARKING MACHINE . . .

Smaller than normal hydraulic marking machines is Model 710. It stands on a 18″ x 20″ space, but will mark everything much larger machines are designed to handle. It performs normal marking operations up to 8000 lbs pressure, with a maximum lettering



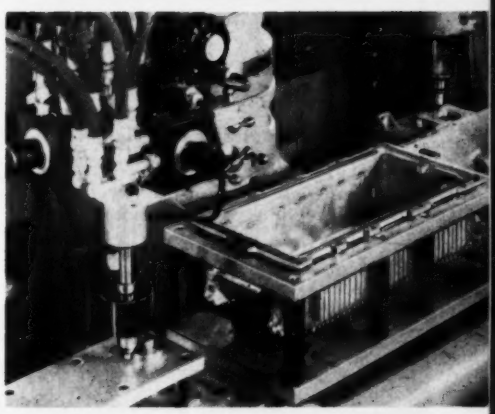
length of 3½″. It will stamp up to 4 lines of 1/16″ characters. Model 710 accepts flats up to 5″ thick and rounds to 5″ dia. Production capacity is 800 to 1000 parts/hr. Parker Stamp Works, Hartford, Conn., or — **No. A8.**

SCRIBER . . .

Designed for faster die layout, scoring, etching, engraving and marking in toolrooms, etc., is the Micro-Scriber. It will scribe or etch all metals including hardened steel, aluminum, brass, bronze, etc. Its solid carbide tip is diamond ground and precision lapped. The Greist Mfg. Co., New Haven 15, Conn., or — **Inform-A-Gram No. A9.**

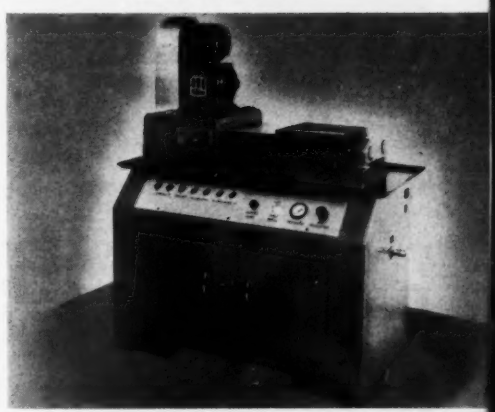
TRACER CONTROL SYSTEM . . .

This new tracer is a magnetic sensing type stylus by which a closed two-dimensional or 360° contour is reproduced automatically. It is adaptable to any standard milling machine. Turchan Follower Machine Co., 8259 Livernois Ave., Detroit 4, or — **Circle A10.**



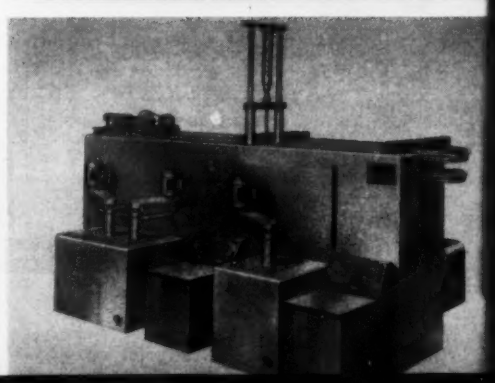
BORING MACHINE . . .

The headstock of this precision boring machine is self-contained and fastened with T-bolts, allowing variable location laterally with the table. Two headstocks can be mounted side by side for rough and finish boring, for boring two holes at once or simultaneous boring and facing. Jones & Lamson Machine Co., Springfield, Vt., or — **Inform-A-Gram No. A11.**



CLEANING SYSTEM . . .

Clean blind holes and difficult recesses of castings, engine parts, stampings, valve bodies, etc., with this automatic 5-stage Monorail ultrasonic cleaning system. Ransohoff, Inc., N. 5th & Ford Blvd., Hamilton 41, O., or — **Inform-A-Gram A12.**



For DRILLING, CORE DRILLING, ROUGH and FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work — or both.

Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

Write for full information and prices

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42322 ANN ARBOR RD., U. S. 12, PLYMOUTH, MICH.
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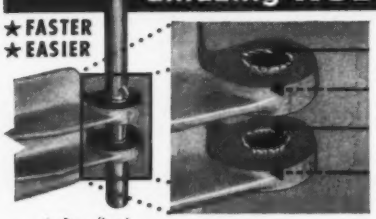
CIRCLE INFORM-A-GRAM KEY NO. 1521

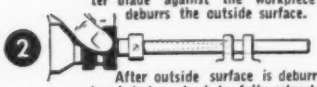
HOW TO.... DEBURR THESE INACCESSIBLE HOLE FACES BY MACHINE OPERATION with the amazing NOBUR TOOL

★ FASTER
★ EASIER

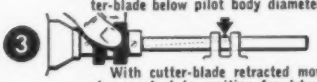


No more hand finishing methods for those hard-to-get-at inner surfaces on multi-wall parts. The NOBUR Tool with its double edge cutting blade does the job in seconds . . . all by **machine operation.** Can be used by anyone, with complete safety, on your own lathe, drill press, etc. Simple to operate.

1 Insert NOBUR tool in any machine spindle. A light pressure of the revolving cutter blade against the workpiece quickly deburrs the outside surface.



2 After outside surface is deburred, slide knurled sleeve back to fully retract the cutter-blade below pilot body diameter.



3 With cutter-blade retracted move workpiece or tool to position for deburring inside surface. Raise cutter-blade to deburr first one surface then the other.

Write for FREE Folder
Send for all details on Nobur Tool Products TODAY!

N-11

NO BUR TOOLS **NOBUR MANUFACTURING CO.**
6860 Fairdale Ave., No. Hollywood, California

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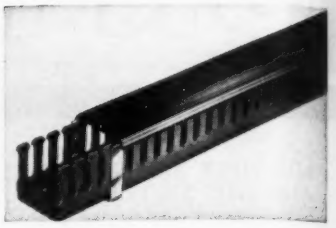
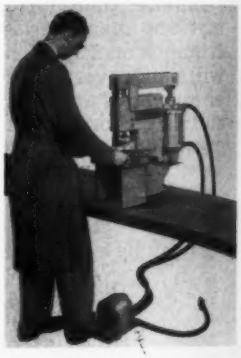


Simplify Control Panel Wiring with the new "snap-on" duct fastener. It is external and does not occupy usable wiring space. The fastener also eliminates the possibility of shorts to the fastener and mounting screw and does not require mounting holes in duct or cover. Panduit Co., Dept. TPC, 10132 S. Washtenaw, Chicago, or — **Circle Inform-A-Gram No. A13.**

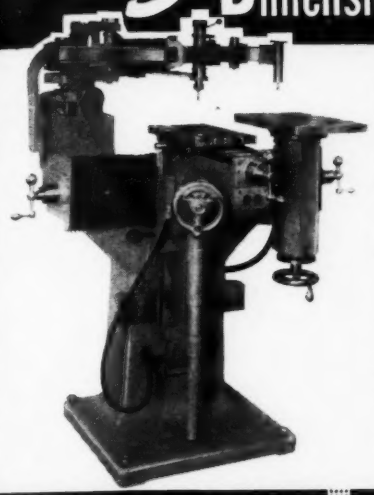
Heavy, Continuous Production is handled by this OBI, 15-ton Rousselle press. Model 2E features an increased die space of 12". This press simplifies operation, minimizes maintenance and assures accuracy and uniformity on press runs. It features 180 strokes/min with a 2" standard stroke. Service Machine Co., 2310 W. 78th St., Chicago 20, or—**Circle No. A14.**



Streamline Operations in sheet metal shops and metalworking plants with an air power notching and punching machine. It can be equipped with a large selection of punches and dies for simple or intricate holes, corner trimming or combination trimming and cutoff. A foot valve frees both hands for locating and feeding the materials. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, or **Circle Inform-A-Gram A15.**

The New Drive System of the 3100 Series spindle shapers makes motor installation possible without tools or bits, through the use of lug-type motors up to two hp. This portable power tool can be used anywhere without anchoring. Details are found in a brochure supplied by Boice-Crane Co., 963 W. Central Ave., Toledo 6, O., or — **Inform-A-Gram A16.**

3-Dimensional panto-miller



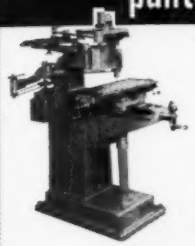
For accurate pantograph milling on all 3-dimensional work, the "Panto-Miller" 3A is a sturdy production machine. Accurately reproduces copy on flat or curved surfaces, in reduced or magnified size.

NEW:

Capacity for workpiece height.
Sensitivity of linkage.
Range of pantograph ratios.
Accuracy of reproduction.
Finger-Tip Control of spindle speeds.
Ease of operation.

The new Panto-Miller 3A is an economical answer to many standard and special production problems. Write for Bulletin PM3, which gives details and specifications.

2-Dimensional panto-miller



Versatile and dependable for continuous service, the J & B "Panto-Miller" 2A:

Engraves
Profiles
Die Cuts
Mills

Special Model 2B with 60" tracer arm available for low cost production of metal stamping dies.

Send for Bulletin PM2

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Simple, Rapid, Positive positioning of workpiece or jig for all angle Drilling, Tapping, or Counterboring. Available with Chuck, Faceplate, or Right-Angle Adaptor Plate. Complete with Station Selector. For details, ask for Bulletin IT3.

WITH RIGHT ANGLE ADAPTOR

WITH FACE PLATE

AVAILABLE SIZES 7", 10", 14", 18", 24"

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PRODUCTION TOOL DIVISION
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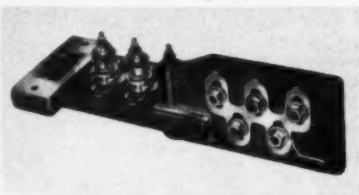
economically priced press room equipment



DURANT Wire Straighteners

Takes round or flat wire and tubing. Five models available. Each unit consists of two sets of 5, 7, 9 or 11 grooved rolls.

Manufacturers of Stock Reels, Roll Feeds, Straighteners, Scrap Choppers, Die Pullers, Foot Presses, Coil Cradles, Press Guards, Stock Oilers.

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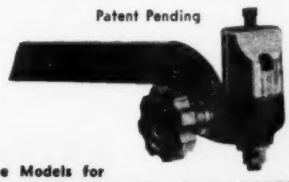
PROVIDENCE 3, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 1532

Monarch Precision SHAPLANE Radius Tools

Patent Pending



Five Models for
LATHES, SHAPERS, PLANERS AND BORING MILLS.

RANGE ¼" TO 3" RADIUS (MODELS ALSO AVAILABLE FOR CONVEX CUTTING, AND CONCAVE RADII TO 6" ON PLANERS, ETC.)

C. B. TEETER
Tool Room Specialties
4470 Oakenwald Ave., Chicago 15, Ill.
Phone Drexel 3-3571

CIRCLE INFORM-A-GRAM KEY NO. 1533

SUPERBORE Counterbores

3 SIZES

STANDARD SIZE

1/64" OVERSIZE

Available from stock for each screw size

1/32" OVERSIZE

NEW!

30° Right Hand Spiral, 4 Flute

Now you can speed up production 100% with our *New* 30° fast right hand spiral, four-flute counterbores.

You will find that faster feeds are possible with this freer-cutting tool.

Hardened counterbore blanks in stock can be ground to any special pilot and flute diameters in one week.

Few territories open for manufacturer's representatives.

FREE!

Complete Reamer catalogue with world's Greatest Reamer selection by the Thousands' and thousandths. Write for it today!

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ROUTE 176 and BRADLEY ROAD
BOX 429TP LIBERTYVILLE, ILL.

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NEW AUTOMATIC CONTROL Trippit PAT. PEND.

Increases Production, Safety of Power Presses, Shears and Brakes

HAND FED OPERATIONS BECOME SEMI-AUTOMATIC

Production Automatic tripping by piece part—automatic gauging—eliminates rejects—prevents die damage—shuts off after pre-set count—counts electrically—protects all operations in automatic set-ups. Automatic tripping and gauging features completely eliminate operator error, nesting and tripping time.

Safety Two-hand safety trip (approved) and quick change foot pedal included. Single stroke or repeat selection.

No alteration of machine needed—installed in one hour. Low cost—complete.

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Designers of low-cost, automatic production and safety devices.

GENERAL AUTOMATION CORP.
65 SOUTH BROADWAY, YONKERS, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1541

FREE... 64 PAGE CATALOG

WORLD'S LARGEST LINE OF WORK HOLDING EQUIPMENT—CHUCK JAW BLANKS, CAST ALUMINUM AND MALLEABLE KNOBS, WHEELS, HANDLES—PLUS HUNDREDS OF OTHER JIG AND FIXTURE COMPONENTS

COMPLETE DETAILED SPECIFICATIONS
ENGINEERING DRAWINGS • COST SAVING DATA
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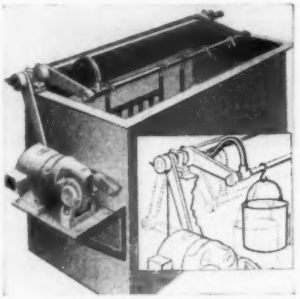
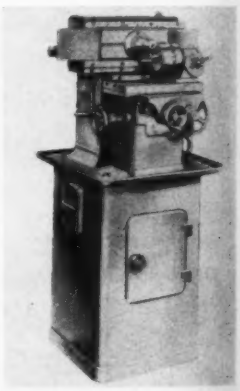
Dept. TE-12, 712 E. 163rd St., Cleveland 10, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1542

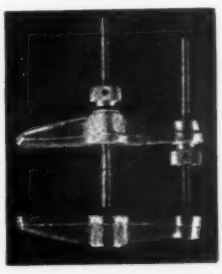
Completely Self-Contained with no parts attached to the press ram are the new Unipunch Series "G" hole-punching units. They are designed for close center-to-center hole locations in angles, channels, extrusions and strips as well as sheets. They have a 7½" shut height and 3⅛" die height for punching holes up to 0.3125" dia in mild steel and up to ⅜" thick on ¾" minimum center-to-centers. Punch Products Corp., 3800 Highland Ave., Niagara Falls, or — **Circle Inform-A-Gram No. A17.**



Quick Cleaning of Metal Parts is possible with an improved motor-driven slusher. Parts suspended on a horizontal rod which moves on an arc, move up and down and sidewise through the solution. Belke Mfg. Co., 944J Cicero Ave., Chicago 51, or — **No. A18.**

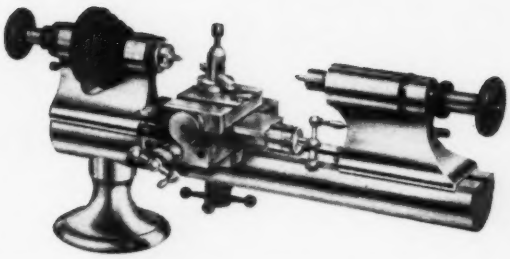


Produce Irregular Shaped Stampings and electrode punches of high precision with the Jemco K-150 form and punch shaper. Punches need no further machining operations when completed on the K-150. A co-ordinate chuck and indexing attachment guides the workpiece along the contour with one chucking. All operations can be checked in the shaping process with a built-in 30-power microscope. Jersey Mfg. Co., 456 Livingston St., Elizabeth, N. J., or — **Inform-A-Gram No. A19.**



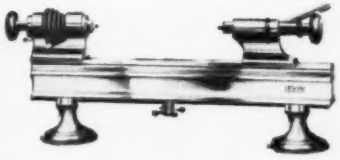
This Vise Action Clamp grips the work straight without side slipping. Made of lightweight aluminum alloy, the clamp insures tensile strength in excess of 40,000 lbs psi. With a capacity to 4½", it has wide application in various kinds of industry. C. B. Teeter, 4470 Oakenwald Ave., Chicago 15, or — **Circle Inform-A-Gram A20.**

ARE YOU DRIVING TACKS
WITH A
SLEDGE HAMMER?

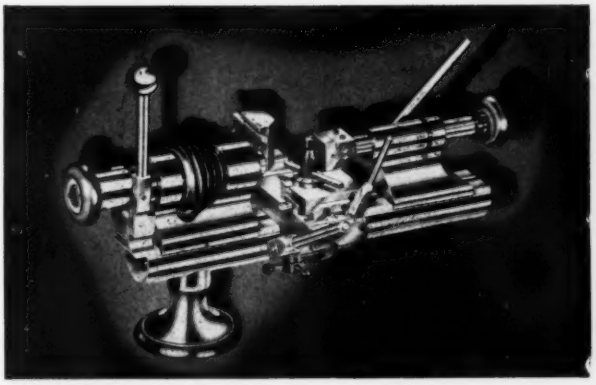


SMALL PARTS ARE MADE WITH GREATER ACCURACY • ECONOMY • SPEED
ON *LEVIN* INSTRUMENT LATHES

For efficiency small work should be done on a small lathe. In many cases the work done on an instrument lathe requires a degree of precision and fine finish which cannot be obtained from larger machines. LEVIN lathes are made in two collet capacities, 5/16″ or 3/16″, and thirty-three different models.



Send for Catalog M describing complete line of instrument lathes and accessories. Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, California.



CIRCLE INFORM-A-GRAM KEY NO. 1551

new—
low cost

• fast set-up—saves time and money
• low cost operation—uses standard tool bits
• heavy-duty hydraulic circuit—assures accurate keyways
• compact, 21″ x 61″—no special foundation
• versatile—cuts standard, tapered keyways; internal splines

HYDRAULIC KEYSEATER

ONLY WITH BLISS' new Hydraulic Keyseater can you get such a size range *from one machine*—¼″ to 2″ wide, to 12½″ long, standard or tapered. It's easily set up for short or long production runs in small, medium or large plants, warehouses, maintenance departments. What's more, no foundation is needed. Speeds range up to 35 spm; heavy-duty hydraulic system is to JIC specs. All adjustments are readily accessible. Seven cutter bars, with standard tool bits, are also available. Special attachments permit internal spline cutting.

Get all the cost-cutting, time-saving facts by writing today for Bulletin 34—

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E. W. BLISS COMPANY
1132 North Seventh Street
San Jose, California

CIRCLE INFORM-A-GRAM KEY NO. 1552

just ONE

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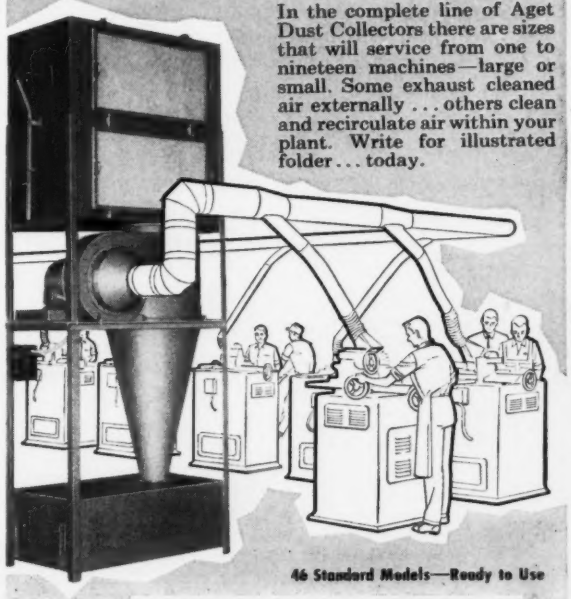
heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



46 Standard Models—Ready to Use

AGET manufacturing company
1394 Church Street • Adrian, Michigan

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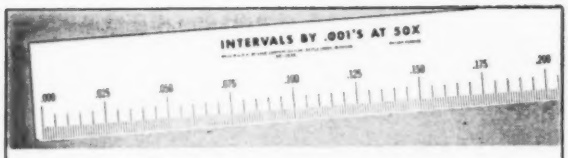

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COMPARATOR SCALES

Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

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GAGE COMPANY
BATTLE CREEK, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1561

HAND KNOBS
6 SIZES
CAST IRON

Tapped, Reamed or Blank.
Hex-shaped hub for extra tightening.

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TIETZMANN TOOL CORPORATION
Dept. HK-2 • Englewood, Ohio

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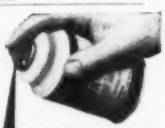
Now Available in "SPRAY ON" CANS and in "BULK"
CROWN design layout ink



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Order it the way you use it most—in handy Aerosol spray can or in pints, quarts, gallons or barrels in bulk. No waste, no mess, no stained hands—Crown ink dries to an excellent scribing texture in a minute. Also ideal for "OK" or "reject" inspection marking.

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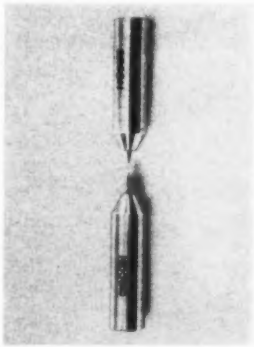
CIRCLE INFORM-A-GRAM KEY NO. 1563

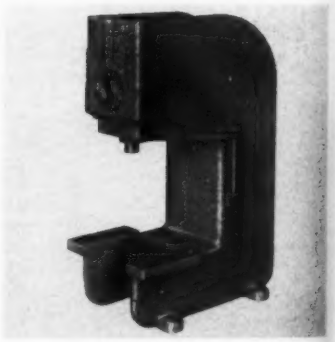
A New Model Measuring Stage for the Wilder Micro-Projector has been announced by Opto-Metric Tools, Inc., 137 Varick St., New York 13. The long range measuring stage reads to 0.0005" and has a capacity of 1½" x 4". Pieces up to 4" long can be measured at one time without relocating the workpiece. For literature, contact the company, or —

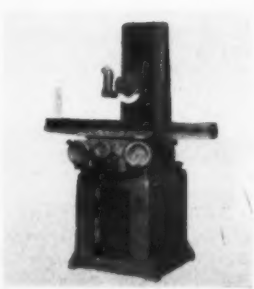
Circle Inform-A-Gram No. A21.



Flexible, Inexpensive Tooling for precision, eyelet rolls is provided by new eyelet setting tools. They are adaptable to basic machines and can be used in a drill press, arbor press, kick press, punch press, air press, etc. One set of tools will set all lengths of eyelets in any diameter series. Circon Component Co., Santa Barbara Municipal Airport, Goleta, Calif., or — **Circle A22.**

A Minimum Air Savings of 75% is possible with the Speed Press, air-hydraulic press. It is ideal for a complete range of light metal assembly operations and where a wide variance in thickness is encountered, and for plastics, etc. The press features a power package. Studebaker Hydraulic Products Co., 1733 N. 33rd Ave., Melrose Park, Ill., or — **Circle Inform-A-Gram No. A23.**

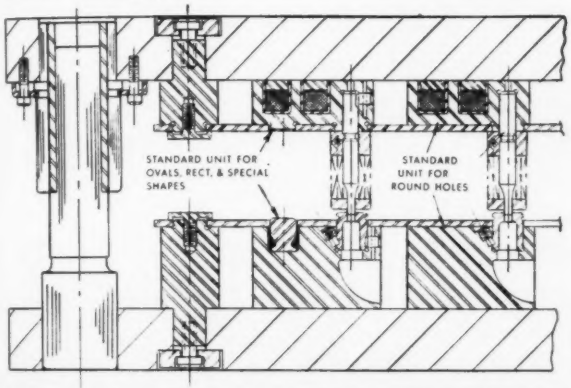


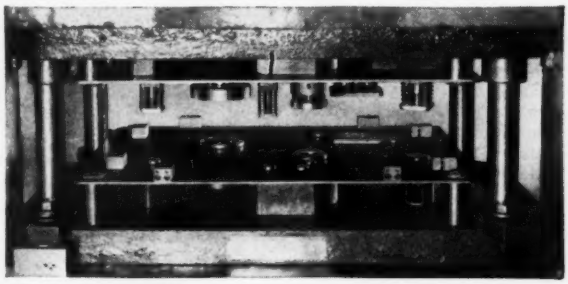


A New Line of 618 precision surface grinders has been introduced by Reid Brothers Co., Inc., Elliott St., Beverly, Mass. They feature low-pressure automatic lubrication systems and crossfeed adjustments from 0.001" to ¼". Three models are available—618P, 618PT and 618H. **Inform-A-Gram No. A24.**

MAGNETIC DIES by WHISTLER

• Operate like a single-purpose die • All punch and die parts interchangeable • Pierce metals up to ¼" thick steel • Changes made from one operation to another while the die set is in the press • Change-over time from 5 to 20 minutes, depending upon size of die set • Lower die costs • Saves die storage space • Precision work in any size press • Backed by Whistler's 40 years of die making experience serving the nation's leading plants.





YOU NEED THIS CATALOG... Shows by photos, drawings and prices how the Magnetic Die* system drastically cuts die costs, saves valuable time, speeds production. *Write for it today.*

**Whistler Magnetic Dies are fully patented and are sold under the registered trade name Magna-Die.*

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748 Military Road, Buffalo 23, N. Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

CIRCLE INFORM-A-GRAM KEY NO. 1571

ALL in ONE TOOLHEAD*

BORING
FACING
TURNING
GROOVING
UNDER CUTTING

SIX SIZES AVAILABLE

ALL HAVE POWER FEED FOR FACING

Model "D"

* A BORING HEAD THAT WON'T FACE IS NOT COMPLETE

CHANDLER TOOL CO
Muncie, Indiana

WRITE for COMPLETE DETAILS

COMBINED BORING & FACING TOOL HEADS
Chandler-Duplex

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CUT PRODUCTION COSTS!
MARK
NAME PLATES
5 TIMES FASTER

MODEL EMT-1
ELECTRIC TAG TYPEWRITER
A touch of the finger delivers up to 2 tons pressure for deep, legible impressions in metal or plastic tags.

—WITH—
Automark
ELECTRIC TAG MARKING MACHINES

MODEL SRST-2
HI-SPEED
TAG MARKING MACHINE
Automatically marks BOTH constant and serial numbers at any desired speed up to 8,000 tags per hour!
MANUFACTURERS' AGENTS
Some Territories Still Available
Send Now for Bulletin

DEFIANCE MACHINE & TOOL COMPANY
1921 S. VANDEVENTER ST. LOUIS 10, MO.

CIRCLE INFORM-A-GRAM KEY NO. 1573

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

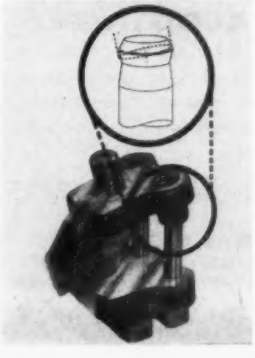
ABERDEEN, SOUTH DAKOTA

CIRCLE INFORM-A-GRAM KEY NO. 1581

A Means of Controlling Rake Angle on the cutting edges of taps is provided by the Blake Flute Grinder. The correct cutting angle according to the material to which the tap is used, is obtained. The machine also corrects any minor errors in the accuracy of indexing. Edward Blake Co., Inc., 437 Cherry St., West Newton 65, Mass., or — **Circle Inform-A-Gram No. A25.**

Designed for Punching Printed Circuit Boards is Model 10-AA Fabricator. This press reproduces any pattern of holes up to 15" x 25" area from a master template. Holes of any shape from 0.030" to 3½" dia can be punched in most dielectric materials. Punch changes can be made in 15 sec in sizes up to 1¼" dia. Wales-Strippit Corp., 345 Payne Ave., N. Tonawanda, N. Y., or — **Circle No. A26.**

Heavy-Duty Adapters to accommodate a new series of 1½" shank dia end mills for aluminum and its alloys are now available from stock. They are standard for No. 50 NS drive machines. Direct front-spindle flange mounting provides quick-change action. Goddard & Goddard Co., Detroit 23, or — **Circle Inform-A-Gram No. A27.**



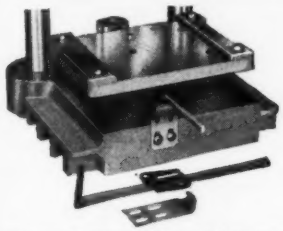
Eliminate Jamming or Binding during assembly of precision die sets with a new type of die set post. The McVey Post features a ground taper lead which automatically guides the die set punch holder into the correct mounting position without hammering or tapping. It is available for both two and four post die sets. Standard Die Set Mfrs., Inc., 1501 Elmwood Ave., Providence 7, R. I., or — **Inform-A-Gram No. A28.**

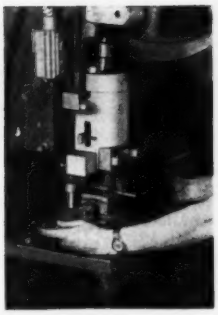
Adjustable Automatic Stock

FEED STOP for DIES

Dahlstrom Light Duty

AUTOSTOP





No drill jig...
No slotting...
No milling...

$1.75

Tested and improved through the years, the Dahlstrom Autostop will save hours of your high priced labor. Adjustable to work with blanking, progressive and compound dies. Mounts on stripper plate in 15 minutes. Handles sheet steel up to 1/16" x 6" or equivalent weight.

TO INSTALL: Just drill one 7/32-inch hole, then drill and tap four mounting holes per directions. That's all there is to it!

Trial order $1.75 each; lots of 12 $1.50 each. State whether for use on compound or progressive dies. *Write for free pamphlet.*

By the makers of the DAHLSTROM TAP GUIDE

Branch MANUFACTURING COMPANY

16 OLSON DRIVE • NORTH BRANCH, MINN.

CIRCLE INFORM-A-GRAM KEY NO. 1591

ACCURATE *
SHOCKPROOF
FULLY-JEWELED

Patents Pending.

Em-re PRECISION DIAL INDICATORS

SIMPLE, UNIT CONSTRUCTION

The new "Em-re" represents the first real advance in indicator design in decades. The case and gear assemblies are joined to form a rigid unit with a minimum of parts. The design is so simple that anyone with a small screw driver can assemble them. "Em-re" indicators have only 31 parts. What's more . . . 25 of the parts are common to each model. Available in 24 models in 6 ranges from .025" to .250" with graduations in .00005", .0001", .00025", .0005" and .001".

Write today for Bulletin 455-E describing the many remarkable features of this new line of indicators.

*Well within A.G.D. accuracy specifications.

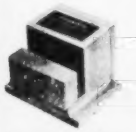
PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 1592

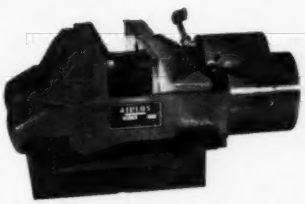
AIRLOX devices

TM REG. U. S. PAT. OFF.

AIR VISES — ALL TYPES GRIPS — 5 TO 200 X AIRLINE PRESSURE

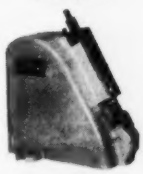


POWER HEADS

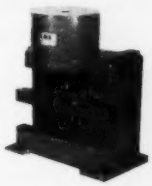


PAIRS-AIR FIXTURES FOR CUT-OFF MACHINES

TERMINAL CRIMPERS



SPECIAL PRESSES



CYLINDERS

by production devices incorporated, Whitehall, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1593

Make 3 hammers AT ONCE!

It's the NEW, easy, economical, quick way to mold your own lead hammers on a production basis with "SHUR-GRIP" handles and this COOK production mold.

COMPLETE LEAD HAMMER SERVICE

Write for circular and prices

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PRESSURELOK-224

the best diamond wheel ever developed for carbide tool grinding. Guaranteed ultimate cutting life from each diamond particle in every wheel.

UNITED STATES DIAMOND WHEEL CO.
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IMMEDIATE DELIVERY on all wheel sizes, STRAIGHT, DISH, CUP, FLARE and MOUNTED WHEELS; HONES.

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IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

You Need an Extra Hand Now to Speed Up Production!

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Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work now—save money too!

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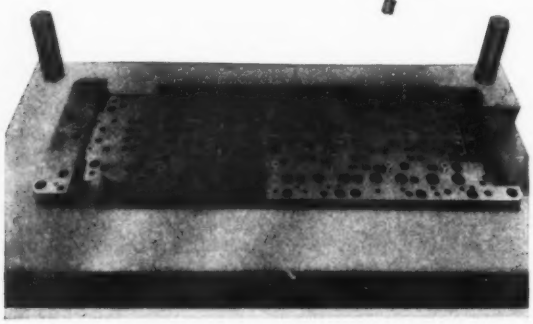
HOLES JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



A seven station die from Vulcan's contract Tool Room (Your Tool Room in Dayton).

Standard sized punches and buttons were used. But since forming and piercing operations were involved, hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

*Vulcanaire equipment pays for itself on the first job.

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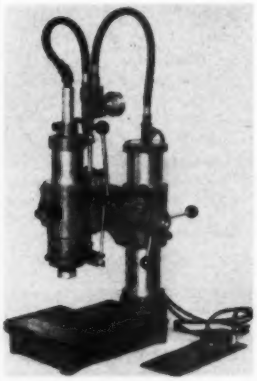
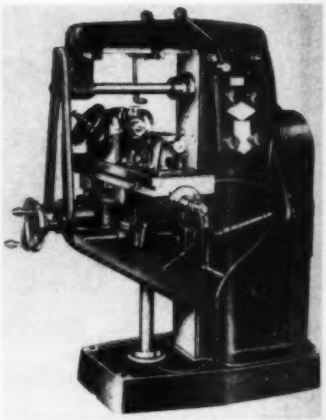
Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.
741 LORAIN AVE. • DAYTON 10, OHIO
CIRCLE INFORM-A-GRAM KEY NO. 1601

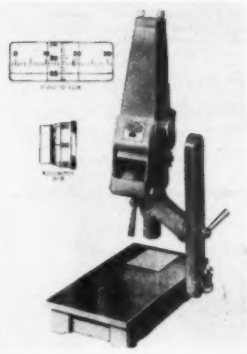
Model FF-12 Flat Finisher has been designed for wet abrasive belt grinding, polishing and deburring of flat work such as sheets, strip, bars, stampings, plates,, etc. It will handle work up to 12" wide and 6" high. Hammond Machinery Builders, Inc., 1631 Douglas Ave., Kalamazoo, Mich., or — **Circle Inform-A-Gram No. A29.**



This Pneumatic Impact Machine is the largest in the variable stroke series produced by Heidrich-Nourse Co., 631 E. 3rd St., Los Angeles 13. Model 300-VS is a single-acting air hammer which operates on constant air pressure. Impact range is from 0 to 20,000 lbs. This machine is used for staking, one-shot riveting, impression marking in metal, pressure assembling, etc. Obtain folders on the machine from the company, or — **Inform-A-Gram No. A30.**



Automatic Feeds in Three Directions are a feature of the Pedersen Model VPU-O milling machine. It is an intermediate machine built for average capacities with all of the automatic features of heavier milling machines. Accessories are also available. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, or — **Circle No. A31.**



Direct Readings to ½ Sec are possible with the Hilger & Watts Projection Angle Dekkor equipped with an optical micrometer. For rapid inspection and production jobs, this improved instrument provides a direct means to determine squareness, parallelism, tilt and change of angle, regardless of distance. Literature is supplied by Engis Equipment Co., 431 S. Dearborn St., Chicago 5, or—**No. A32.**

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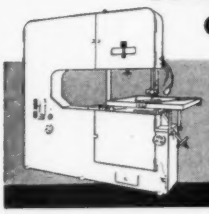

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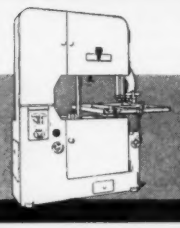
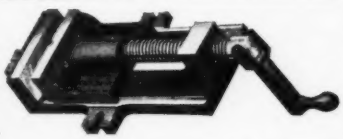


CIRCLE INFORM-A-GRAM KEY NO. 1611



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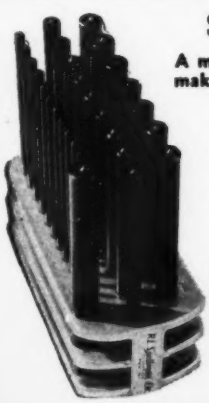

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A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

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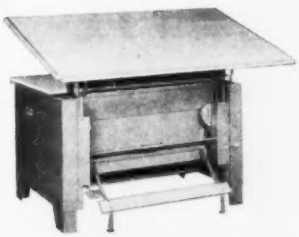

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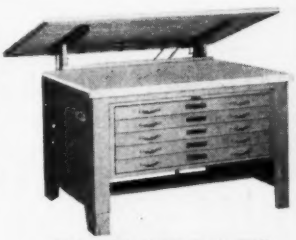

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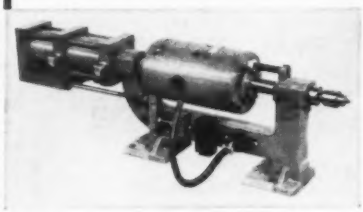

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3 SIZES cover Drilling Range from #80 to 1/2" — Units can be Mounted in Any Position to Build Special Machines

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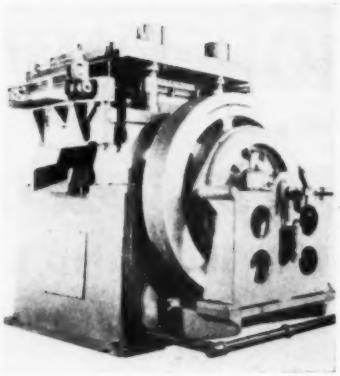
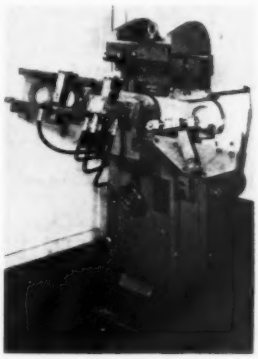


Larger Flywheel Type Presses up to 350-ton capacity for high speed production have been developed by Brandes Press Co., 6408 Euclid Ave., Cleveland 3. Shown is a press able to operate at speeds of 150 strokes/min. These presses feature a large bed area to accommodate larger progressive dies. **Circle No. A33.**

Check Strip Stock as it is being fed to the punch press with a continuous measuring recording gage. Model 493 B-139 is mounted in a wheeled cabinet and is placed between a feed roll and a punch press, so that the strip stock goes through the gage before it reaches the press. The gage shown is adjustable to measure stock from 0.015" to 0.100" thick and from 5" to 18" wide. Federal Products Corp., 1144 Eddy St., Providence 1, R. I., or — **No. A34.**



Mark on the Periphery of Ring Gear Blanks with Model 175-S marking machine. Serial number or fixed lettering, or both can be incorporated in the marking tool. The entire operation is automatic. Parts are rolled into the feed chute at right of the machine from the preceding operation. Geo. T. Schmidt, Inc., 4112 Ravenswood Ave., Chicago 13, or — **Circle No. A35.**

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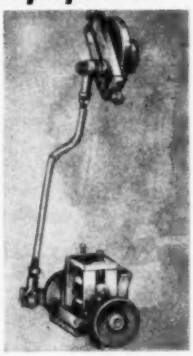

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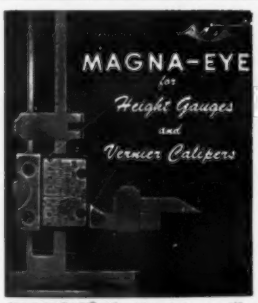

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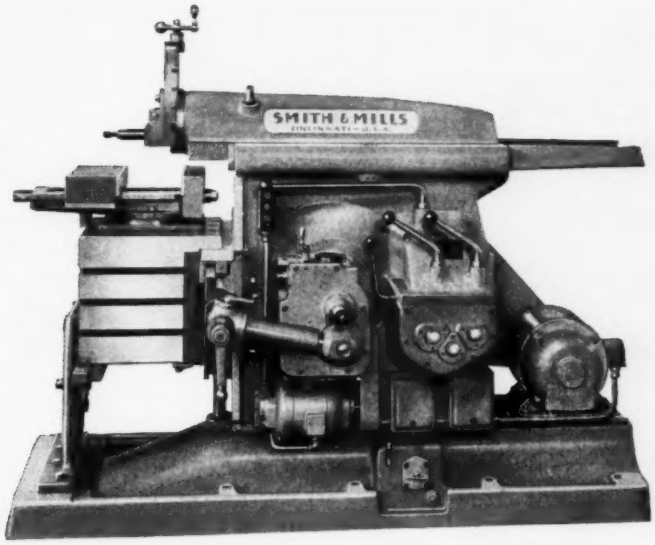

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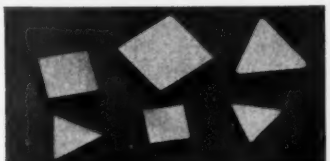

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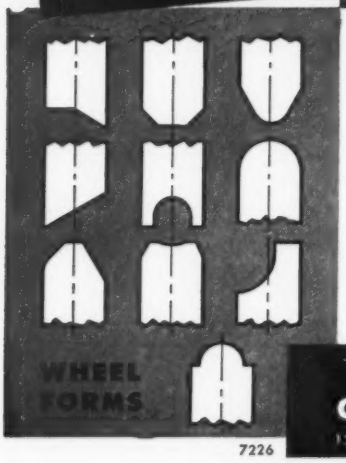

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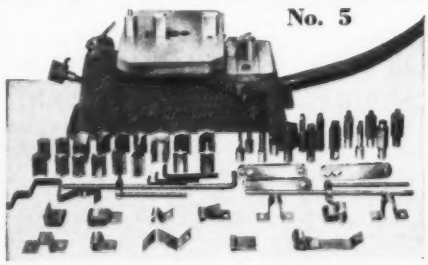

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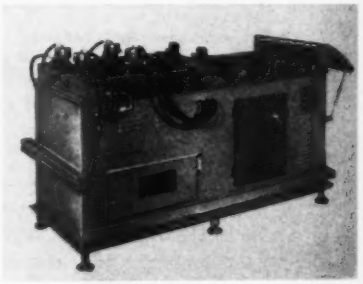

maximum stroke length of 32". This hydraulic unit will operate under 500 psi pressure. Special Engineering Service, Inc., 8161 Livernois Ave., Detroit 4, or —
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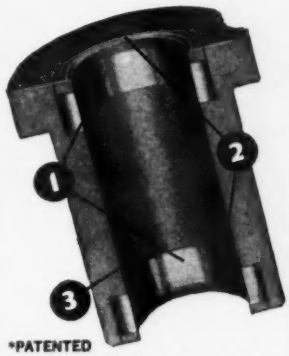

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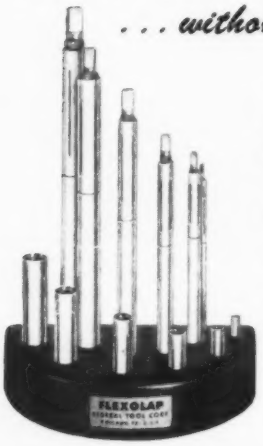

The Flexolap barrel is made with a series of longitudinal slots milled "off-center" to permit sensitively flexible expansion up to 15% — or more — under pressure of the adjusting pin. This construction enables Flexolap to save valuable time and to lap rounder, straighter holes. For accurate precision take-up, as desired, to maintain size and compensate for wear on barrel . . . simply turn adjustment screw.

Illustrated at left is Flexolap Set No. 1. Includes 6 complete laps, one of each size (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2"), and one additional brass barrel of each size, all held on a sturdy, serviceable stand. Price complete $14.00

Also available in sizes 7/32", 9/32", 11/32", 13/32", 15/32", 9/16", 5/8", 11/16" and 3/4". For lapping holes smaller than 3/16", use the Midget Lap. Seventeen sizes: .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218, and .250. Trial assortment (17 laps) $2.10

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CIRCLE INFORM-A-GRAM KEY NO. 1661

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COMPARE...No matter what material you are presently using for tools and fixtures, Red Seal's Alloy 2424-C will give you better performance, lower costs, and increased production.

INVESTIGATE . . . Red Seal Aluminum Alloy 2424-C for your tooling requirements. Call or write for this new Red Seal Aluminum Products catalog today.

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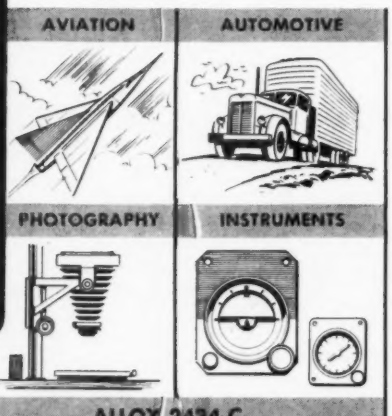

ALLOY 2424-C

Alloy 2424-C is Red Seal's new designation for their aluminum tooling plate and bar stock. The new designation is to help you better understand material composition. The "C" indicates material is cast.

RED SEAL METALS CO.
10035 Burtis Street
South Gate, Calif., LOrain 6-5105

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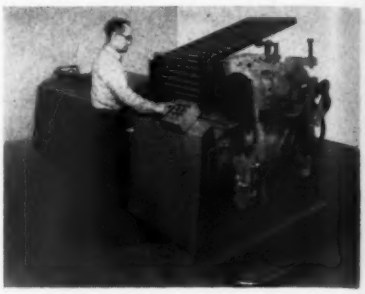
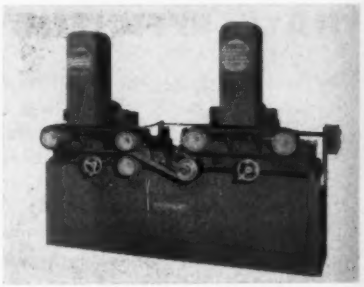
Automatic Tube Bending is performed by a heavy-duty, high-speed tube bending machine. It provides an automatic means of bending tubing up to 2" dia to adjustable bend



angles up to 180°. For example, this machine will bend 2" dia steel tubes 90° in a 4-sec bending cycle without any operator handling. Walter P. Hill, Inc., 22184 Telegraph Rd., Detroit 19, or —
Circle Inform-A-Gram No. A41.

With the Swivlstool, there is no limit to mobility within an area of over 4' dia. It can be mounted into the floor, or can be mounted onto the machine. Once mounted, the worker can be directly in front of his work whether at one end or the other of the long reach of the stool. When not being used, the Swivlstool swings out of the way. A & A Mfg. Co., Warsaw, Ind., or —
Circle Inform-A-Gram No. A42.

Grind, Polish or Debur both sides of a workpiece in one handling of the stock with Model 304C2 double side grinder. It incorporates a turn-



over transfer unit, between conveyorized abrasive belt heads. This model is the smallest in the Straight-O-Matic line. The Curtis Machine Corp., Jamestown, N. Y., or —
Circle Inform-A-Gram No. A43.

Transport Small Parts, Chips, Shavings, clippings, liquids and waste with a low cost materials handling cart introduced by Coolant Equipment Corp., Verona 2, Wis. Model 47 cart has easy clearance under work benches, hoppers, feeders or machine tools. It features a short turning radius and a capacity of seven cu. ft. **Inform-A-Gram No. A44.**

Cut Finishing Costs THROUGH INCREASED PRODUCTION

AUTOMATIC MACHINES
Increase production hundreds to one over hand methods. Reduce labor costs. Eliminate need of experienced workmen.

CLAMPS AND FIXTURES
Positive pressure and exact registration of the part in the mask. Reduce rejects. Free both hands for productive movements.

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A competent engineering staff will counsel with you on the most efficient technique for handling your particular requirements.

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50% faster than any other make. Cut solvent consumption. Avert production delays due to damaging of masks by hand scrubbing.

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BY A QUICK, EASY, INEXPENSIVE METHOD
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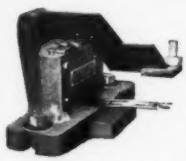
Wilmerding, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1672



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BAUSCH & LOMB
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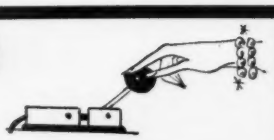
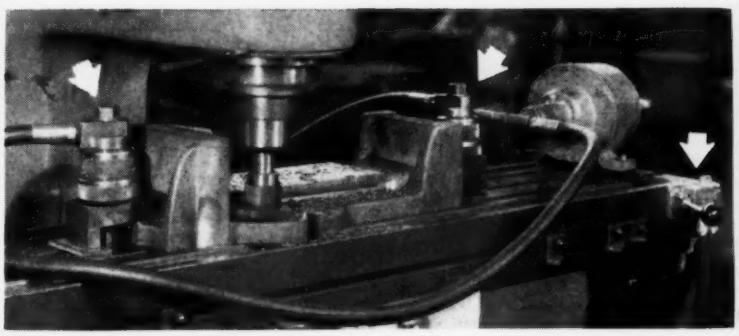
PowRlock gives this hand a 6000 lb. GRIP!





PowRlock AIR-HYDRAULIC CLAMPS provide instant automatic clamping on most existing machines and fixtures. Eliminate nuts, bolts, manual tightening, slash "reloading" time. Hydraulic pressure in the head activates a piston, which exerts up to 6000 lbs. locking force at one to 4 points. Comes complete with air-hydraulic system in 14 models. UNCONDITIONALLY GUARANTEED!

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You Can Rely on a ROUSSELLE

THESE 40-TON PRESSES take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are very moderately priced.

Manufacturers of Rousselle Presses

Significant savings may result if you let our engineering staff assist you. There is no obligation.

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Rousselle Presses are sold exclusively through leading machinery dealers.

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Choice of 25 models in 5 to 40-ton sizes.

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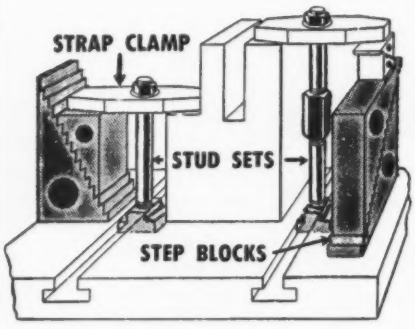

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Clamping tools of all types.

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DYKEM STEEL BLUE
Stops Losses
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Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.
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With DYKEM Steel Blue
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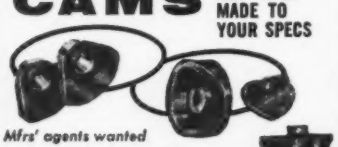
CAMS ALL TYPES MADE TO YOUR SPECS



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400 MODELS

Prompt Delivery
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CIRCLE INFORM-A-GRAM KEY NO. 1685

A Universal Bed Type Milling Machine has been announced by Sundstrand Machine Tool Co., Rockford, Ill. The Rigidmil combines longitudinal feed of the table, cross feed of the column and vertical feed

of the head. Twenty-four speed changes are available on both the horizontal spindle and the all angle head, from 14 to 1450 rpm. This machine is designed with mechanical screw feeds for application of controlled tracing and programming.
Circle Inform-A-Gram No. A45.

A High-Speed Electronic Gage Team is available from The Sheffield Corp., Dayton 1, O. It consists of a small electronic pickup cartridge, Electrojet, for incorporating in new and existing gages and precision instruments, and a portable electronic amplifier, Accutron. The small Electrojet is an ideal size sensing element for a large variety of gaging devices. It can be used with the full range of Accutron amplifications. Teamed with the Accutron, the Electrojet provides accurate, high speed indication of part size over a wide tolerance range.
Circle Inform-A-Gram No. A46.

Measure and Analyze acceleration, velocity and displacement of mechanical vibrations from 3 cps to 20,000 cps with Model 12A Vibrometer. Used with an oscilloscope, the device permits quantitative analysis of impact shock and impulsive motions. Televiso Corp., 1415 Golf Rd., Des Plaines, Ill., or —

Circle Inform-A-Gram No. A47.

MERRY CHRISTMAS ★ HAPPY NEW YEAR

MAY YOUR HOLIDAY JOYS BE MULTIPLIED!

★ With our customers and friends we want to lay aside business cares for the moment and join in spirit to celebrate the joyous Holiday Season.

For you and yours may it be the best ever, full to the brim with deserved happiness and good cheer, and topped with the rich blessings of peace and good will.

To this is added our best wishes for a most Happy and prosperous New Year.

THE WELDON TOOL COMPANY
3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

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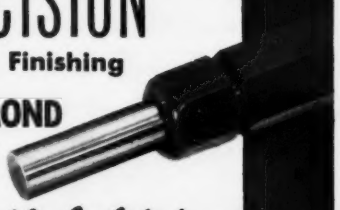
FOR PRECISION Carbide Finishing
ELGIN DIAMOND IN DYMO-C
...Designed for Carbides!



Where precision really counts, finishers specify ELGIN Diamond because they can be sure of:
- consistant accuracy—uniform cutting action
- flawless finishes every time, in less time

Actual field tests prove this new diamond abrasive up to 20% faster for finishing carbides.

Send for the DYMO-C bulletin today!

ABRASIVES DIVISION, Dept. D
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

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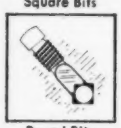
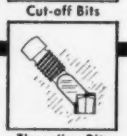
ONE Clark LATHE TOOL HOLDER Grips 3 bit shapes

Square Bits


Round Bits

Cut-off Bits


Threading Bits

Many Bit Sizes!

Clark LATHE TOOL HOLDERS do the *USUAL* and *UNUSUAL* JOBS BETTER IN EVERY SHOP—*SOLIDLY GRIP* ROUND, SQUARE and RECTANGULAR SHAPES—Enable turning, threading, boring with bars as well as cut-off operations with *ONE* tool holder!

Special vee clamp operating on diagonal accommodates several bit sizes, grips *full length of the cutter channel*. Holds bits tighter, eliminates chatter and harmonic vibration. Excellent rigidity for carbide tools!

4 Clark Lathe TOOL HOLDER SIZES cover complete range of lathe requirements from ⅛" bits to ⅝" bits. Write for prices or order from your dealer.

Robert H. Clark Company
9330 Santa Monica Blvd., Beverly Hills, California

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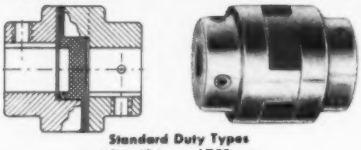
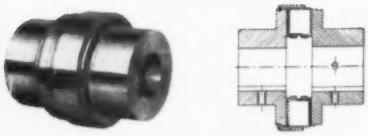
Lovejoy

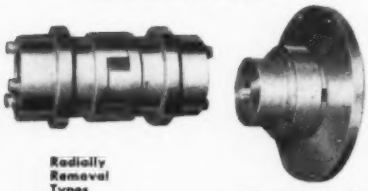
Maintenance-Free FLEXIBLE COUPLINGS



Standard Duty Types
.05 to 40 hp. at 1750 rpm.



Medium and Heavy Duty Types
2.6 to 810 hp. at 100 rpm.



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1.9 to 30 hp. at 100 rpm.—2 to 40 hp. at 1800 rpm.

Flange-Mounted Types
11 to 740 hp. at 900 rpm.

Put Trouble-Free Performance Into Your Equipment

COMPARE THESE FEATURES:

- A type and size perfectly suited to your application.
- Year-after-year dependability, regardless of load or operating conditions.
- Completely machined for ease and speed of alignment.
- No lubrication required.
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- Cushions are engineered to the load and service conditions.

Ask Lovejoy to recommend the exact flexible coupling for your application. No obligation. Request catalog.

LOVEJOY FLEXIBLE COUPLING CO.

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- Ratios from 1.7:1 to 7:1
- Areas at 2:1 ratio —4-5/16" sq. 4½" circle
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A high precision, sturdily constructed, widely adaptable machine for engraving steel stamps, dies, other metals, plastics, fibre, wood, etc.

By simple attachment of additional accessories this machine may also be used for ELECTRICAL MARKING and ACID ETCHING.

Several models available for 2 and 3 dimensional engraving.

Write for NEW Bulletin B-2 of the complete line and ask for catalog UE-3 with price lists.

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For immediate attention write directly to manufacturer. Ask for nearest representative.

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.0003 HOLE LOCATION IN 1 MINUTE

EDGE FINDERS

$2.50 NEW POSTPAID except C.O.D. $10.00 DELUXE

- THOUSANDS HAVE PROVEN AND ACCEPTED THE DELUXE MODEL FOR YEARS.
- JUMPS SIDEWAYS AS SHOWN WHEN LOCATION IS REACHED.
- NEW .500 DIA. MODEL FOR LARGER WORK ONLY.

.200 Dia.

ADJUSTABLE VISE STOP

$2.95

HUNDREDS OF PIECES TO A .0003 TOLERANCE WITH THIS HARDENED VISE STOP THAT IS ADJUSTABLE IN ALL DIRECTIONS. ATTACH TO VISE WITH ONE ¼—20 TAPED HOLE.

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Handles stock up to 3" wide, ⅛" (app.) thick

Write for details

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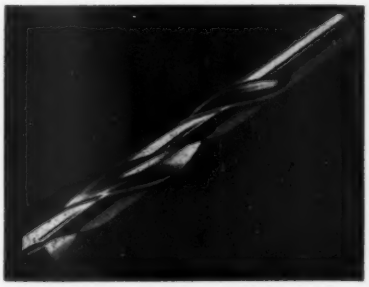
Fast, Efficient Drilling in Cast Iron is performed by a new series of carbide tipped drills. Series 333 drills feature a specially designed point



which facilitates penetration of the work. They are stocked by 64ths in the ⅛" to ½" dia range and can be made to standard jobber lengths. Ace Drill Corp., Adrian, Mich., or — **Circle Inform-A-Gram No. A48.**

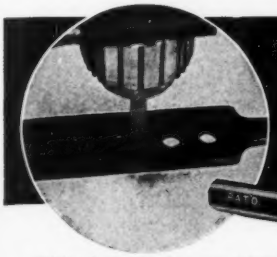
Rugged Construction, Large Capacity, ease of adjustment and ample power are features of a heavy-duty master profiler and contour grinder. It is used in tool and die shops for fast removal of metal on steel punch or heavy press die sections. The grinder performs accurate free-hand rough and finish profiling. The grinding wheel is oscillating or non-oscillating. The Kindt-Collins Co., 12651 Elmwood Ave., Cleveland, or— **Circle Inform-A-Gram No. A49.**

Designed for Use on the Multiple Spindle Screw Machine is a new type of Master Feed Finger. The finger can be adjusted at the machine. The new Master Feed Finger is available

for all types of multiple spindle automatic bar machines. Green Mfg. Co., 122 S. Prairie Ave., Rockton, Ill., will provide literature, or — **Circle Inform-A-Gram No. A50.**

The Push-Pull Tapper is a small instant-reversing speed reduction unit designed for tapping. It attaches to any portable drill. The speed reduction of 7:1 in the driving direction provides adequate power to tap all materials. The direction of the tap can be reversed without stopping the drill motor. The Push-Pull Tapper handles all taps up to 5/16". Supreme Products Corp., 2222 S. Calumet Ave., Chicago 16, or — **Circle Inform-A-Gram No. A51.**

Drill Hardened Steels without Annealing –



USE The New IMPROVED "HARDSTEEL" DRILL

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon–high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It— With "HARDSTEEL"

BLACK DRILL COMPANY, INC.
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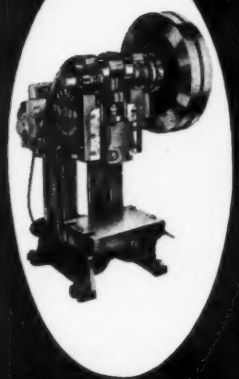
"HARDSTEEL"

CIRCLE INFORM-A-GRAM KEY NO. 1711

KENCO

1½ TO 15 TON
PUNCH PRESSES



PRECISION-BUILT FOR FAST, TROUBLE-FREE PRODUCTION

Here at last is a complete line of small punch presses built to big press standards. You get rugged construction throughout . . . minimum need for adjustments . . . minimum downtime . . . capacity far beyond the ratings . . . steady, economical production.

Write for literature and engineering data.

Trouble free crankshaft has no weakening slots . . . eliminates driving dog breakage. One piece, alloy steel construction

Flywheel driving plate is hardened and ground, assuring long wear and positive drive—a quality feature exclusive with KENCO presses

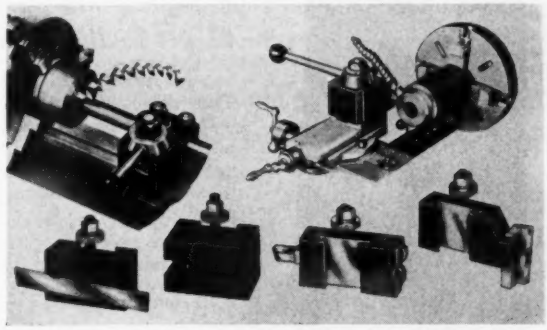
KENCO MANUFACTURING CO.
Mfrs. of Precision Machinery and Accessories
5211 Telegraph Road
Los Angeles 22, California

CIRCLE INFORM-A-GRAM KEY NO. 1712

NOW! LATHE USERS CHANGE TOOLS in a ... FLASH ..

ALORIS QUICK CHANGE TOOL POSTS & HOLDERS

Speed Your Operation . . . . Save You Money



Only a second to change tools for turning, facing, drilling, boring, threading, knurling, cutting off or any other operation.

- Great Repetitive Accuracy
- Rugged Construction
- Tested and Recommended by Leading Lathe Manufacturers
- Greater Rigidity
- Saves 90% In Set-Up Time
- Unconditionally Guaranteed

Write for catalog and price list.

ALORIS TOOL CO., INC. 131-37 SANFORD AVENUE FLUSHING 55, N. Y.

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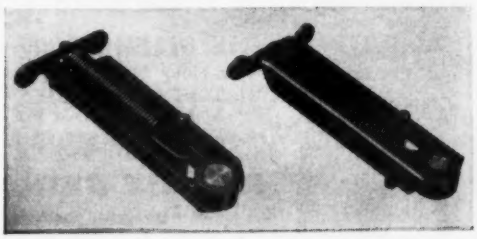
FOR POSITIVE STOCK ALIGNMENT

IN PROGRESSIVE DIES



Amcor Roller Stock Pushers

SPEED UP PRODUCTION with precision-made AMCOR Roller Stock Pushers. Easy, smooth stock feeding, without buckling, assures more production with less operator fatigue.

SAVE MONEY. AMCOR Roller Stock Pushers sell for just a fraction of what hand-made bench models cost to make.

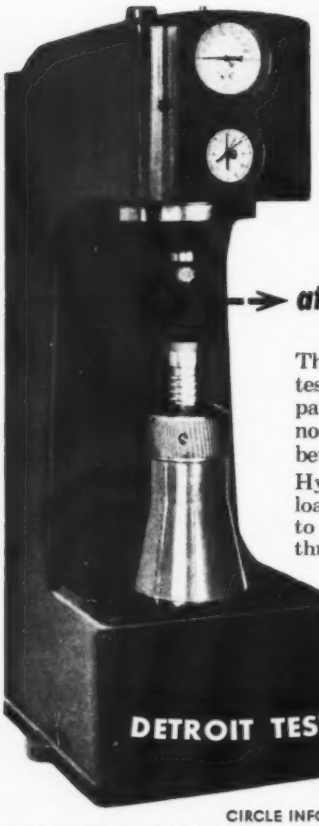
SIMPLE TO INSTALL. Requires only a slot milled in the stripper plate, and a hole drilled in the die block and stripper plate. Tracing template for slot and hole location is supplied. When die is sharpened, no refitting is necessary.

The AMCOR Roller Stock Pusher is quickly adaptable to any work specifications. Distributors throughout the country stock a complete line of nine models to fit all production needs.

Write us for complete information

APPLIED MECHANICS CORPORATION
460 LYON, N. E. GRAND RAPIDS MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1714



Brinell Testing

→ at production line speeds! →

This direct reading Brinell hardness tester tests round or flat parts *fast*. No grinding of parts is necessary and the operator simply notes that the dial indicator needle falls between pre-set tolerance hands.

Hydraulically applied standard Brinell test loads are used. Foot control allows operator to test parts as quickly as he can move them through the machine.

Write for more information on all our Brinell testing machines.

DETROIT TESTING MACHINE COMPANY

9386 Grinnell Ave., Detroit 13, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1721

Smoother Production! Higher Output! Lower Costs!

RICE-MILWAUKEE

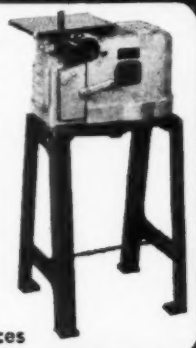
DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping.

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.

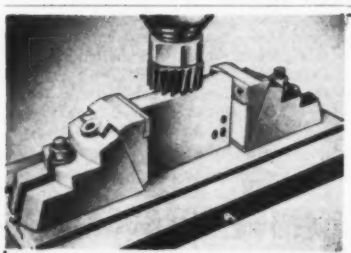


Write for Illustrated Bulletins and Prices

RICE PUMP & MACHINE COMPANY

228 PARK AVENUE BELGIUM, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 1722



MASTER GRIPPING CLAWS

System Hubner

WHY use them?

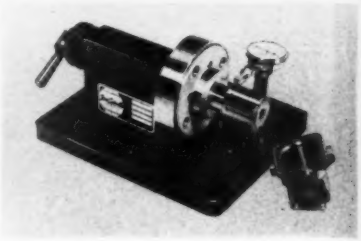
1. Clamping action Vertical as well as Horizontal—pressing workpiece down directly on the machine table. No hammering and still no air between.
2. Gain more working room.
3. Faster and more secure setups. Easier to handle.
4. Unlimited jaw opening.
5. No straps overlapping on the workpiece; more machining surface.
6. Extremely versatile—take light cuts or heavy cuts, use on small machines or heaviest production machines.

Exclusive Agents: KARL A. NEISE, 404 4th Ave., N. Y. 16, N. Y., Dept. TP

NEISE MODERN TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 1723

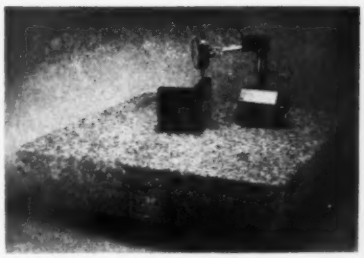
A Complete Inspection Fixture made up of stock parts has been released by N. A. Woodworth Co., 1300 E. 9 Mile Rd., Detroit 20. The Tork-Lok collet arbor and the Zero Spindle inspection fixture details are



combined, resulting in a precision chucking tool for checking concentricity and/or squareness. The interchangeable collet feature permits a number of parts to be checked on one fixture.
Circle Inform-A-Gram No. A52.

A Magnetic Plate Handling Attachment for industrial lift trucks has been announced by The Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15. It insures fast, safe handling of metal plate. The attachment, mounted between the forks of a Yale electric truck, is operated automatically by a control switch. Turning the switch off permits regular fork handling with the lift truck.
Circle Inform-A-Gram No. A53.

Prevent Sticking with high silica and quartz content granite surface plates. Special lapping as required in diabase, for relief of ringing action, is eliminated. For details on



the line of grey-granite surface plates with 70.70 silica content, contact Herman Stone Co., Dayton, O., or — **Circle Inform-A-Gram No. A54.**

Series 1000 Large Mel-O-Flo Coolant-Aerators have been introduced by Melard Mfg. Corp., 432 Austin Pl., New York 55. They are used for 1¼" or 1" coolant lines on large machine tools. These coolant-aerators connect directly to the coolant line to produce a non-splash aerated mixture that clings to work and tools. A self-cleaning mechanism purges them of chips and sludge whenever the coolant supply is interrupted.
Circle Inform-A-Gram No. A55.

* Write for literature on complete line of furnaces and ovens. Ask for Hints on Heat Treating.

Designed for TOOL ROOM EFFICIENCY

HUPPERT *Heat Treating* FURNACES

Range: 300° F. to 2000° F.

Years of satisfactory operation in tool, die and machine shops, as well as laboratories have proven these furnaces to be ideal for production work. Huppert special features include High Temperature, Heavy Duty Kanthal elements—Multi-insulation—counter-weighted and tight self-sealing door. Pilot lights indicate furnace operation. All connections factory installed, shipped ready for operation.

Model No.	Inside Dimensions			KW	Prices 220 volt single phase	
	Wide	High	Deep		With Huppert input controller	With electronic temperature controller
869	8"	6"	9"	4	$280.00	$480.00
11	8"	6"	12"	4	298.00	506.00
12*	8"	8"	12"	6	382.00	590.00
12A*	8"	8"	18"	9	490.00	698.00

*For 2300°F. add $95.00 to No. 12 and $105.00 to No. 12A. No. 12A can be furnished for 3 phase at no additional cost. For floor model add $52.00 to above prices.

K. H. HUPPERT CO.

6820 Cottage Grove Avenue, Chicago 37, Illinois
Manufacturers of Electric Furnaces and Ovens

CIRCLE INFORM-A-GRAM KEY NO. 1731

KEEP YOUR MACHINES LEVEL

With EMPCO leveling jacks!

For peak efficiency and longer life, level your machines with EMPCO Jacks! Easily installed and re-located, EMPCO Jacks provide quick, easy machine set-ups *plus* smooth, positive adjustment! Used with VI-SORB mounting pads, Empco jacks control vibration, reduce noise, prevent creepage and cut machine maintenance costs! In many cases they eliminate the need of anchor bolts in installations.

Available in six styles and 25 models, Empco's are designed to meet your requirements. Write today for complete information and illustrated bulletin!

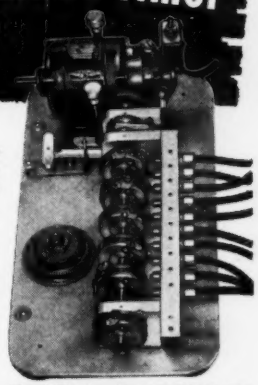
EMPCO PRODUCTS

THE ENTERPRISE MACHINE PARTS CORPORATION

2735 JEROME AVENUE • DETROIT 12, MICHIGAN

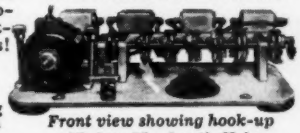
CIRCLE INFORM-A-GRAM KEY NO. 1732

THIS CLEVER, DEPENDABLE Electro-Pneumatic Timer Controls Intricate Work Cycles . . .



This simple but astonishingly ingenious unit distributes air pressure to air-operated cylinders, presses, hammers, work feeders, clamping fixtures, chip blowers, work ejectors . . . each independent as to start, duration and end of cycle. Simply connect up 6, 12 or more cylinders in numerous sequences from 2½ to 33½ seconds. *You need this inexpensive* Mead Electro-Pneumatic Timer for cost-saving automation jobs!

No. 6 Electro-Pneumatic Timer



Front view showing hook-up with four Meadmatic Valves

Write Factory or Nearest Mead Representative For Bulletin HA-12

Write for our cost-saving catalog. Or let the Mead Man show you.

(See Volume IV Thomas' Register for nearest distributor's address, phone number.)

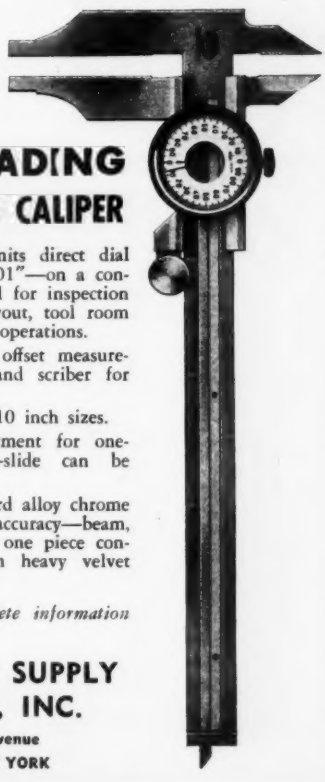
MEAD SPECIALTIES COMPANY

4114 N. Knox Ave., Dept. HA-126 Chicago 41, Ill.

PATHFINDER IN AIR POWER AUTOMATION

CIRCLE INFORM-A-GRAM KEY NO. 1733

New RAPID READING DIAL VERNIER CALIPER



This new Caliper permits direct dial reading accuracy to 0.001"—on a convenient dial scale—ideal for inspection set-up, tool and die layout, tool room and other machine tool operations.

For inside, outside or offset measurement. Optional base and scriber for use as a height gauge.

Available in 5, 6, and 10 inch sizes.

Handy roll fine adjustment for one-handed measurement—slide can be locked if desired.

Constructed of super-hard alloy chrome steel for continued accuracy—beam, slide, and jaws are all one piece construction. Furnished in heavy velvet lined case.

Write today for complete information and prices.

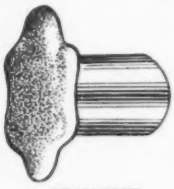
TITAN TOOL SUPPLY COMPANY, INC.

1419 Hertel Avenue
BUFFALO, NEW YORK

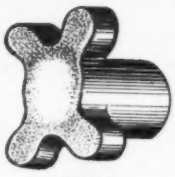
CIRCLE INFORM-A-GRAM KEY NO. 1734

REID TOOL ROOM Accessories

CAST IRON HAND KNOBS

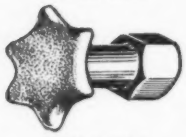


SCALLOPED



PRONG

Made in three types and a wide variety of sizes. Designed to improve appearance of product. Well proportioned with eye appeal. Made of fine grain cast iron. Smooth finish—no sharp edges. Can be supplied drilled and tapped or drilled and reamed when desired. Low prices.



LONG SHANK
With Wrench Hexagon

Also

Get our low prices for plastic and steel ball handles, machine handles, compression springs, etc.

Quality at Moderate Prices!

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REID TOOL SUPPLY CO. Muskegon Heights, Mich.

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PAYS FOR ITSELF

Time and Time Again

Wardwell's 57 T, Circular Saw Grinder, will sharpen as many as 250 Milling Cutters, Slitting and Screw Slitting Saws .015" thick at one time with a variation, plus or minus .001" of exact diameter for entire lot. Automatically indexes the gang of saws, one row of teeth at a time. Steady, accurate, durable. Grind either wet or dry. A time and money saver.

Also can be arranged to feed the grinding wheel into the work without attention of the operator.

Ask for Bulletin describing 57 T

WARDWELL MANUFACTURING CO.
3809 Ridge Rd., Cleveland 9, O.

Maker of Largest Line of Saw and Tool Sharpening Machines

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Why SCHNORR Disc Springs?

BECAUSE

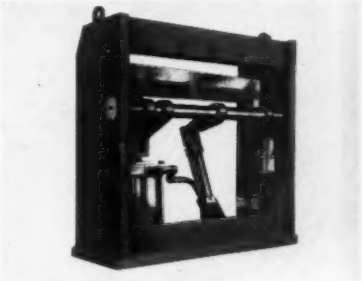
1. Unlimited life within borders of permissible loads.
2. No creeping, initial settling or gradual fatigue.
3. Axial center pressure.
4. Exact adjustment to the desired pressure.
5. Small constructional height, large deflection.
6. Large inherent damping.
7. Large impact damping especially with multiple stacking.
8. Excellent space disposition.
9. Spring pressure, Spring length and Spring deflection can be easily determined for the same Spring size or can be changed by lengthening or shortening of the Spring columns or by multiple stacking. In special cases the character line can be made to divert from its usual straight form by diversified stacking.
10. Most spring sizes available from stock.

KARL A. NEISE, Dept. TP
404 Fourth Avenue, New York 16. N. Y.

NEISE MODERNTOOLS

CIRCLE INFORM-A-GRAM KEY NO. 1743

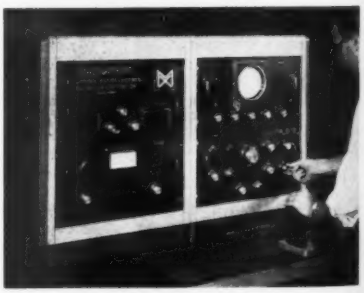
Designed for Cutting Ferrous and Non-Ferrous Strip is a new series of air-operated shears. Previously they were produced only for cutting rounds and other bar stock. The shears will cut strip up to 3/16" thick



in mild steel and widths from 24" to 84". They are recommended for cutting hot or cold carbon or stainless steel, copper, aluminum and other metals. Curry Air Shear Corp., 941 Oliver Bldg., Pittsburgh 22, or — **Circle Inform-A-Gram No. A56.**

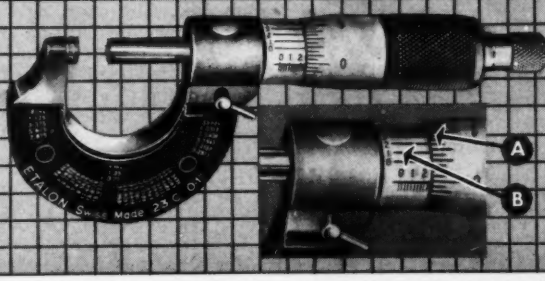
A New Line of NesTier materials handling boxes, priced lower than the Heavy Duty line, has been announced. The General Purpose boxes are available in five sizes ranging from 12" to 36" long and will support stacked loads of from 300 to 1200 lbs. They are fabricated of a lighter gauge metal than the Heavy Duty units and have no bottom runner. Literature on the units is provided by Chas. Wm. Doepke Mfg. Co., Inc., 8911 Blue Ash Rd., Rossmoyne, O., or — **Circle Inform-A-Gram No. A57.**

Inspect Non-Magnetic Rod, Wire, Tube and Bar with the automatic Magnatest FW-400 inspection unit. This instrument detects such problems as seams, overlapping, diameter changes, inclusions, voids, concentrated porosity, metallurgical variation and splits. It is suited for high



speed plant operation and designed to cover the whole range of nonmagnetic materials from aluminum, brass and copper to tungsten, austinetic stainless and titanium. Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, or — **Circle Inform-A-Gram No. A58.**

ONE PIECE STAINLESS STEEL SPINDLE AND SCREW
Hardened and ground from the solid . . .



ETALON 23C MICROMETER

A—Half-thousandth graduations on thimble allow tenths readings with only 5 Vernier graduations.

B—Deep machine divided graduations on both thimble and barrel assure easy reading.

• Reads to .0001" • Forged frame • Heavy duty tungsten carbide measuring faces, optically lapped • Quick acting positive lock • Feather touch friction stop assures senstive feel • Dull chrome finish on thimble and barrel eliminates glare • Built for accuracy under the most rugged applications • In handsome contour case.

ALINA

WRITE FOR CATALOG on complete line of precision measure instruments:
VERNIER CALIPERS • MICROMETERS • DIAL INDICATORS

ALINA CORPORATION
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CIRCLE INFORM-A-GRAM KEY NO. 1751

IT'S *Economy* ALL THE WAY!

— when you order your duplication requirements for these Standard Items . . .

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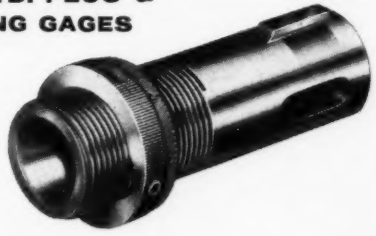

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"TRU-LOC"
Adjustable Adapter Sleeves and Nuts

"Economy" stocks always complete to assure immediate delivery. Worn-out plugs and ring gages salvaged at low cost.

Ask about the new "Economy" Extended O.D. Symbol Range. Dimensional Data Sheet No. 7-A Upon Request.

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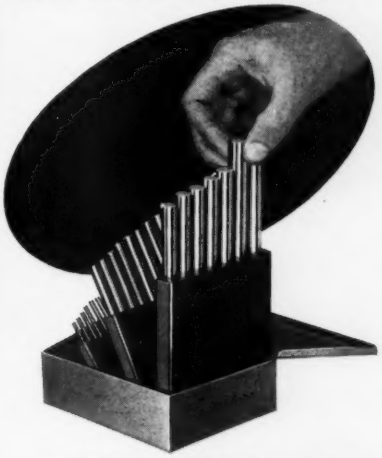
CIRCLE INFORM-A-GRAM KEY NO. 1752

Now available in 182 standard sizes to meet your exact requirements



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hardened high speed steel
DRILL BLANKS

These versatile, low-cost drill blanks are made of top quality, uniformly hardened high speed steel precision ground to exacting tolerances to meet the requirements of countless applications. Ideal for use as dowels, punches, knockout pins, gages, and rollers. Readily adaptable to form a wide variety of end cutting tools, too. And they're offered now in 182 standard stock sizes and in sets as shown.

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL
ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

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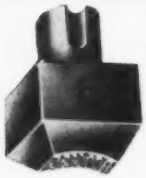
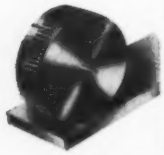
MATTHEWS MARKING Products

"every need for every industry"

Matthews General Purpose Machines mark round or flat parts up to 6" diameter-models from hand operated to pneumatic-hydraulic to mark up to 800 pieces per hour.



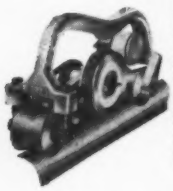
Full line of stamping and embossing steel dies in any size to suit your needs.



Roller dies engraved to your specifications–may be mortised for interchangeable inserts.

High production machines produce thousands of marks per hour on round, solid or hollow parts. Fully automatic.

6 styles of Standard Steel Type Holders for light to heavy duty service.



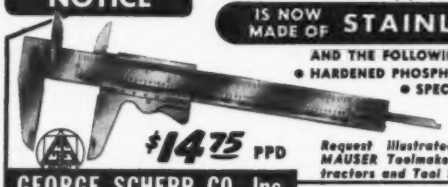
Portable and motorized bar, tube and sheet Printingunits, with permanent or soluble inks for every application.

JAS. H. MATTHEWS & CO.
3946 FORBES ST.
PITTSBURGH 13, PA.
BOSTON CHICAGO PHILADELPHIA CLIFTON, N. J.

Write for literature and catalogs for your applications.
CIRCLE INFORM-A-GRAM KEY NO. 1761

IMPORTANT NOTICE

The Genuine MAUSER **VERNIER CALIPER**
IS NOW MADE OF **STAINLESS STEEL** THROUGHOUT
AND THE FOLLOWING IMPROVEMENTS HAVE BEEN ADDED
• HARDENED PHOSPHOR-BRONZE adjustable gib retains accuracy
• SPECIALLY LONG VERNIER to read thousandths
• 3 GRADUATIONS - 1/1000" - 1/128" 1/10 mm in back



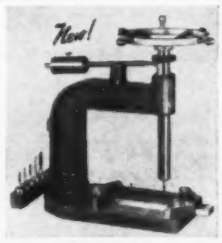
$14.75 PPD

Request illustrated folder showing complete line of MAUSER Toolmakers Calipers, Height Gages, Bevel Protractors and Tool Stands.

GEORGE SCHERR CO., Inc.
200-T Lafayette Street • New York 12, New York
CIRCLE INFORM-A-GRAM KEY NO. 1762

Low Cost Automatic
HORIZONTAL STOCK REEL
Self-powered
24" dia. $85.00
30" $90.00
36" $95.00
Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass.
CIRCLE INFORM-A-GRAM KEY NO. 1763



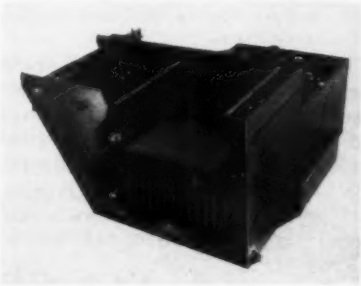
LASSY
SUPERSENSITIVE HAND TAPPER

New exclusive features and top quality make Lassy Tappers outstandingly the finest available. Write for illustrated circular showing 3 models, and also Universal Tap and Die Guide.

LASSY TOOL CO. Plainville, Conn.
CIRCLE INFORM-A-GRAM KEY NO. 1764

Indicate the Open or Closed Condition of a Switch with the Doylite Switcheck. The device proves the correct mechanical position as well as the electrical condition of it. It minimizes the costs of down-time by immediately pin-pointing the failure of an electrical circuit. The Switcheck is used in connection with the operation of machines controlled by precision snap action switches. Doyle Design & Machine Co., 51-57 Scio St., Rochester 4, N. Y., or — **Circle Inform-A-Gram No. A59.**

Designed for More Efficient Filtration and maximum flow capacity of coolants, cutting oils and all liquids requiring removal of minute particles is the Delpark Filter-Matic



Filter. This tubular screen type filter features 5 to 1000 gpm flow capacities. For details, contact Industrial Filtration Co., Dept. FM-299, Lebanon, Ind., or — **Circle Inform-A-Gram No. A60.**

Fast, Low-Cost Tool and Die Repairs are possible with threaded plug stock. A complete line of special alloyed and processed cast iron threaded plug stock has been designed for industrial use. It is heat treated and stress relieved for 45,000 psi tensile strength. Processed from 12" bar, threaded for 11" with American National Coarse thread, this plug stock is made in eight diameters. Claude Sintz Inc., 1928 Stanley Ave., Detroit 8, or — **Circle Inform-A-Gram No. A61.**

A New Baked Synthetic Protective Coating for Nickeloid pre-finished metals, in copper and brass finishes, has been announced. Metals coated with the Bakekote film can be drawn, press formed, stamped, roll formed and seamed with no peeling, cracking or flaking of the protective film. The Bakekote film which is cured with intense heat, provides maximum gloss, flexibility, and chemical and abrasion resistance. American Nickeloid Co., Peru, Ill., or — **Circle Inform-A-Gram No. A62.**

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- TOOL BITS
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Cut your assembly costs . . . speed production . . . eliminate slow, costly hand feeding. Feedmatic rotary hoppers automatically deliver small parts in proper position for assembly over attached feed tracks.

Use Feedmatic hoppers for high speed delivery of parts to machine tools, grinders, special production machines—or for sorting, counting and inspection operations.

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HIGHER SPEEDS/
FASTER GRINDING/

kipp
AIR GRINDERS

Model JA
50,000 R.P.M.
$42.00
IN U.S.A.

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle. That means better work—longer wheel life.

High speed grinding with small wheels was a Madison-Kipp development of the late twenties. It was born out of a pressing need in our tool room. Because tool room grinding problems are universal, we believe it will pay you to utilize Kipp grinders in your tool room as generally as we do in our own.

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212 Waubesa St. • Madison 10, Wis., U.S.A.

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Specify KASSON Precision Collets and Attachments

3AT, 3C, 1A, 4C, 5C

480 (AC-50) "PUSH TYPE. All collets in hexagon, square and round for lathes, milling machines, attachments.

KLUTCH-KOLLET Step collet. Accurate checking to 2¾" dia. Soft head for easy boring. Lowest price on market! Models 3AT, 3C, 5C.

FOR ATLAS • LOGAN • SOUTH BEND • CRAFTSMAN • SHELDON LATHES, ETC.

LEVER-TYPE DRAWBAR ½" cap.

Positive grip on undersize, oversize or standard diameter work. Patented coordinate cams eliminate fingers.

LIVE CENTER (Ball Bearing). Double sealed for accuracy.

HAND DRAWBAR ½" cap.

Let us quote on your quantity orders for any types of collets, live center or other machine tool attachments!

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Surface Plates — Box Parallels
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ACME TOOL CO.
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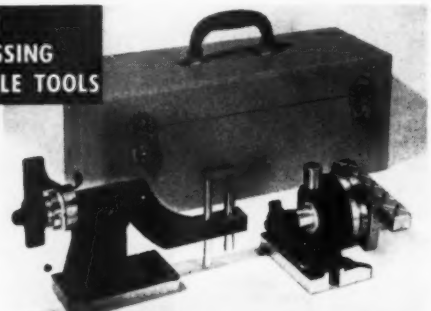
Now ANGLE TANGENT TO RADIUS WHEEL DRESSING WITH NEW VERSATILE TOOLS

MIGHTY GOOD AT ANY PRICE BUT TOPS AT ONLY $149.50
(Both tools including diamonds)

The G-5 RADIUS DRESSER is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on a 7 inch or 10 inch wheel, and it may be set to the exact radii desired. Graduated stops allow you to dress any desired portion of a radius. The spring tension journal insures chatter free operation. The G-2 ANGLE DRESSER AND TOOL HOLDER is actually two tools in one, having an easy to read vernier scale 0° to 180° giving accuracy within 2' of 1°; an excellent time saver to set up small jobs to be milled, drilled, tapped, etc., on any desired angle.



Our fixtures will dress most radii and angles tangent to each other, similar to those shown below.

FREE handsome, wooden storage box. Write for complete information.

Distributorship available in select territories.

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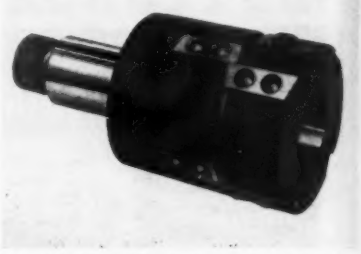
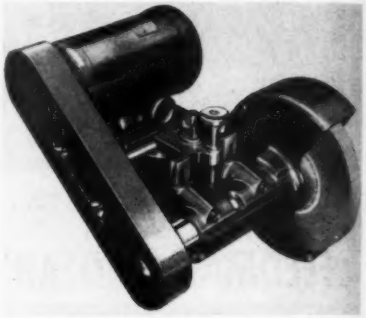
Speed Multiple-Spindle Screw Machine Operations with a releasing-type tap holder. It can be changed quickly and simply for right-hand or left-hand tapping, saving setup time. The tap holder automatically disengages at a pre-determined tap depth to hold consistent tolerances on tapping operations. Marcellus Mfg. Co., Belvidere, Ill., or — **Circle Inform-A-Gram No. A63.**



Convert Standard Machine Tools into Large Capacity Grinders with a 3 hp tool post grinder. Series 25 tool post grinder is designed for heavy duty external grinding applications in production or maintenance. It is adaptable to horizontal and vertical mounting without special quill oilers. For a bulletin with details, write to The Dumore Co., 1300 — 17th St., Racine, Wis., or — **Circle No. A64.**



Sixteen Indexable Cutting Edges per button insert for facing and chamfering in a single operation are available when using this two-in-one Kendex tool. The "turn-over" carbide button inserts are only ½" square. Only the middle of the chamfering insert is used, permitting exchange of the two inserts when each has been used in eight positions. Kennametal Inc., Latrobe, Pa., or — **Inform-A-Gram No. A65.**

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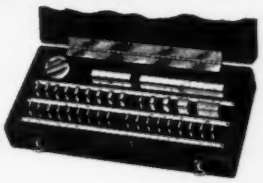
Supplied in one Superior Accuracy

5 MILLIONTHS ± ACCURACY

82 Block Set
$303.00 Complete
This Set will supply the needs of any discriminating shop that must work to gage-block precision.



34 Block Set $132.50
WITHOUT OPTICAL PARALLEL

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Would *you* use a ruler for *precision* measurements?

Pretty silly question. But it's one way of pointing out the solid advantages of JO-LINE Torque Tools over ordinary torque equipment...about like a micrometer as compared with an ordinary ruler. The JO-LINE Torque Wrench gives you:

★ **TORQUE LIMITATION** Here—responsibility for exact torque control rests squarely with the wrench itself—not with various operators.

★ **ACCURATE CALIBRATION** Each JO-LINE Torque Wrench is calibrated to less than 1% error, and is *certified to* within 3% accuracy in writing.

★ **JUST SET YOUR TORQUE** ...cuts out automatically... no lights, dials, or gauges to read. Lightweight and well-balanced, the JO-LINE is as easy to use as a socket wrench.

★ **CENTER OF TORQUE** Use one hand, two hands, or even a long extension handle...the JO-LINE always provides the same unvarying tension.

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- *for torque requirements from 10 inch-ounces to 2000 foot-pounds*
- *designed to meet specifications MIL-H-4034A (USAF)*

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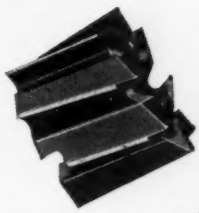
TEARING YOUR HAIR OVER CUTTING TOOL COSTS?

Systematic "NTS" salvage is the best way to cut cutting tool costs



Stop before you discard a worn or damaged cutter. It may be worth many times its scrap value!

Since 1912 we have been restoring all kinds of cutting tools to new usefulness to help shops control their cutter costs.

Can we assist you in studying your operations and tool usage to determine if a salvage program will save money in your plant? There is no obligation.

Write for this catalog and the salvage story.

NATIONAL TOOL SALVAGE CO.
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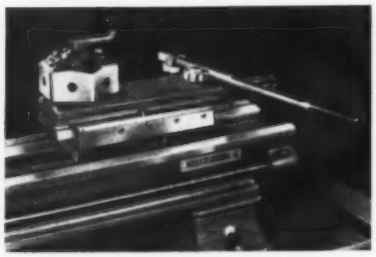
Simplify Repetitive Operations with

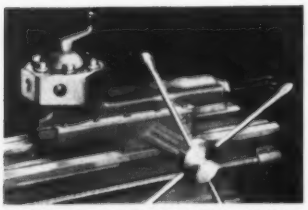
SOUTH BEND TURRETS



HANDLEVER BED TURRET

Indexes ± .0005" at 4". Superfinished index pin. Automatic indexing and feed stops. Effective slide feed 4".

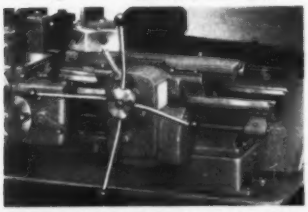
Size Lathe	Catalog No.	Price
9"	CL1611N	$284
Light Ten	CL1611K	291
10"	CL1611R	298
13"	CL1611T	320



HAND FEED TURNSTILE BED TURRET

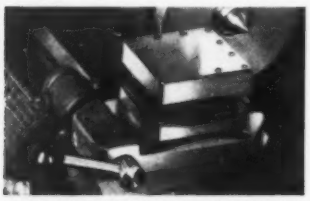
Indexes ± .0005" at 4". Automatic indexing and feed stops.

Size Lathe	Catalog No.	Price
16"	CL1917H	$710
13"	CL1917T	515



POWER FEED TURRET FOR 13" LATHE

Independent feed trip and stop for each of six turret faces. $726



SQUARE TURRET TOOL BLOCK

for Compound Cross Slide

Mounts 4 cutting tools. Turret indexes within .0005" to 4 positions. Quick acting lever lock. For 9" to 16" Lathes — $47.75 to $94.50

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Building Better Tools Since 1906

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KIDDE PRECISION TOOL CORPORATION
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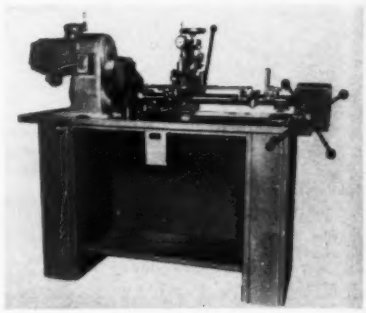
A Centerless Turning Machine makes it possible to turn unusual, intricate shapes, contours and tapers of infinite lengths in one pass, one plunge cut. Workpieces can be precision turned to ±0.0005" tolerances



and fine micro-finish, without tool chatter and tool marks. The machine is built in three sizes. Full details can be had by contacting Turnomat Co., Inc., Dept. BD, Brockport, N. Y., or —
Circle Inform-A-Gram No. A66.

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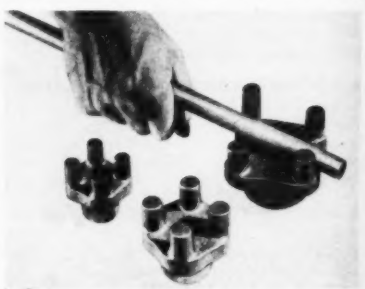
Circle Inform-A-Gram No. A67.

Replace Conventional Cranks and Handles with Speed Bar Knobs. These four-pronged Speed Bar Knobs are easily turned by hand or with a bar or tool handle inserted between the prongs. They can be used to hold down covers, clamp

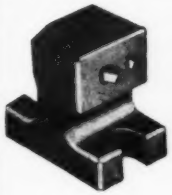


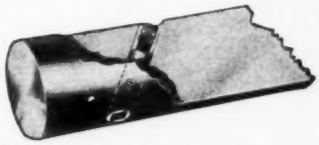
heavy workpieces and as a component in the construction of various types of jigs and fixtures. A complete range of 15 models provides sizes for every requirement. Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, or —
Circle Inform-A-Gram No. A68.

How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!

Patents Pending

One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.





The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

SLEEVES MADE IN FOLLOWING SIZES:
3/16, ¼, 5/16, ⅜, 7/16, ½, ⅝, ¾, 1"

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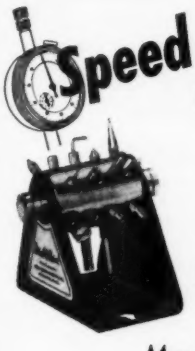

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Mounted on handy steel stand with Chrome Rotating Drum.

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1 Thread Adapter • 1 Top Lift • 2 Extensions

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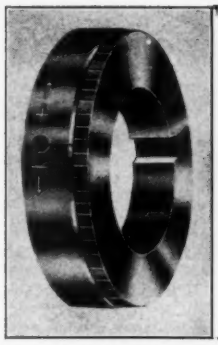

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ON GANG MILLING SET - UPS

These MICROMETER ADJUSTABLE SPACING COLLARS are designed for accurate spacing of side milling cutters, gang milling and various other multiple setups on milling machines. Accurate spacing of the milling cutters is easily made by merely loosening the cutter arbor nut and making a plus or minus adjustment.

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For immediate delivery specify size and mail orders to . . . . . .

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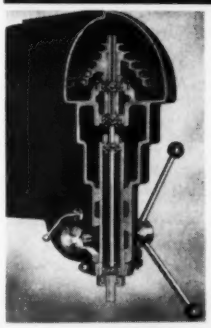

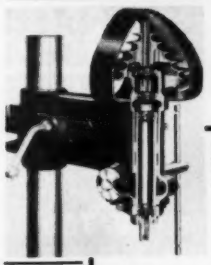

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Get Precision!

KUTMORE ADJUSTABLE HOLLOW MILLS

• ANY COMBINATION OF . . . TURNING . . . TAPERING . . . FACING . . . CHAMFERING . . . TREPANNING IN ONE PASS. • EXCLUSIVE MICROMETER ADJUSTMENT FEATURE FOR RAPID SET-UP. • CUTTING CAPACITIES FROM 1/32" TO 2" DIAMETER IN STANDARD STOCK.

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00 B&S through 1" wide
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plus Davenport Form Tool, Sizing and Roll Blanks through 1" wide.

All by 16ths in High Speed Steel.

Write for complete price list and name of local representative. Complete line of Standard Circular Form Tools available—ask for catalog.

Price and delivery on request for Blanks for other make machines or Blanks of High Cobalt Steel.

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West Coast Warehouse: 576 N. Prairie, Hawthorne, Cal.

CIRCLE INFORM-A-GRAM KEY NO. 1822

Since 1903
black devil
TWIST DRILLS—REAMERS

Ever since 1903, when Celfor pioneered in the forging and hot-twisting of high speed drills, "Celfor" tools have been specified by the nation's leading steel fabricators for the drilling and reaming of the really rugged jobs in the toughest alloy steels.

CELFOR TOOL COMPANY
DIVISION OF AVILDSEN TOOLS & MACHINES, INC.
MAKERS OF "REPUBLIC," "CENTURY," "CELFOR" AND "U. S. EAGLE" BRAND TOOLS

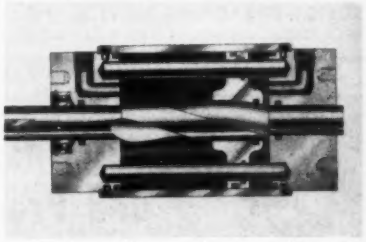
NEW YORK PLANT
100 LAFAYETTE ST., NEW YORK 13, N. Y.
3 PLANTS — NEW YORK CHICAGO — LOS ANGELES

CIRCLE INFORM-A-GRAM KEY NO. 1823

Efficient Inspection of relatively flat objects and small parts is performed by a low-cost portable contour and surface projector. The AO Magnavisa will inspect imprinted

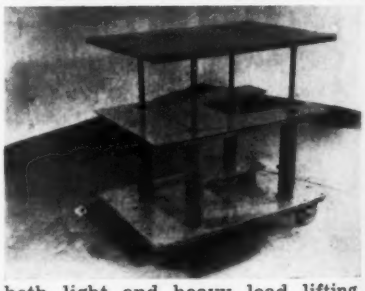
circuits, fine print of small scale drawings, etc. Two models are available, one enlarges the original material three times, and the other, five times. American Optical, Instrument Div'n, Buffalo 15, or — **Circle Inform-A-Gram No. A69.**

Full 360° Rotation and positive stopping at any position are features of the rotary actuator announced by Carter Controls, Inc., 2800 Bernice Rd., Lansing, Ill. Operated on air or oil pressure, the actuator delivers



a fast, positive rotary motion by means of a piston and simple internal helix. Indexing, positioning, cam actions, lifting and transfer mechanism are some of its applications.
Circle Inform-A-Gram No. A70.

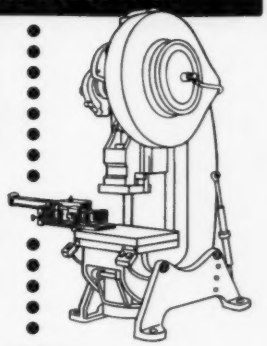
A Tool and Die Elevating Shop Truck has been introduced by Dayton Rogers Mfg. Co., 2824 — 13th Ave., S., Minneapolis 7. The Lift-A-Load truck has a two-speed elevating mechanism compensating for

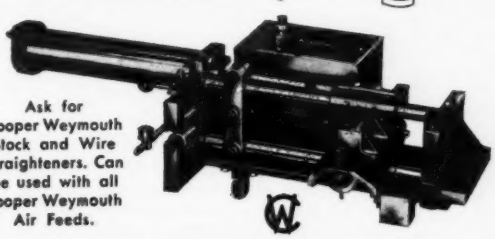


both light and heavy load lifting. It can be used for all press feed work and general and overall tool and die room as well as general punch press activity. **Inform-A-Gram No. A71.**

COOPER WEYMOUTH
AIR OPERATED SLIDE FEEDS
Boost Power Press Production

Specifically designed to solve the automatic feeding problems in press rooms. Simplified, open throat construction. Air operated from standard shop lines. Easily set up and adjusted at the front, rear or sides of press for accurate long or short runs. Cooper Weymouth Air Feeds, made in five sizes, will feed lengths up to 36", of stock up to 18" in width. They are readily adaptable to material of irregular cross section and ideal for use with hydraulic presses.





Ask for Cooper Weymouth Stock and Wire Straighteners. Can be used with all Cooper Weymouth Air Feeds.

SEND FOR INFORMATION ON THESE AND OTHER PRODUCTS

COOPER WEYMOUTH, INC.
600 HONEYSPOT ROAD, STRATFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 1831

If your production calls for **PRECISION HOLES** in volume–
(any size from ⅛" to 10" dia.)

This gage is FOR YOU

USERS INCLUDE:
Airesearch Mfg. Co.
Allison Div.
Apex Electrical Mfg.
Buick Motor Div.
Century Electric Co.
Chicago Pneu. Tool
Chrysler Corp.
Continental Motors
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Detroit Transmission
Douglas Aircraft
Fairchild Engine & Airplane Co.
Falk Corp.
Ford Motor Co.
General Electric Co.
Hamilton Standard Division
Harris Seybold Co.
Homelite Corp.
Int. Harvester Co.
Jacobs Mfg. Co.
Lycoming-Spencer Div.
McDonnell Aircraft
National Lead
Northrop Aircraft
Pontiac Motor Div.
Scintilla Magneto
Steel Products Eng.
Studebaker-Packard
Sylvania (Atomic Div.)
United Airlines
Warner Gear Div.

- Measures precision bores to fractions of .0001".
- True 2-point gaging aligned and centered automatically.
- Shows ACTUAL SIZE in a fixed – not passing – reading.
- Reveals ovality, front or back taper, bell mouth, etc.
- No training program needed, anyone can use accurately.
- Self-contained – no wires, hose, or electronic gear.
- Widely used in Statistical Quality Control programs.

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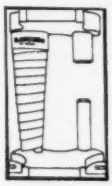
Shows complete details of operation, application and unique advantages.

COMTOR COMPANY
82 FARWELL ST., WALTHAM 54, MASS.

CIRCLE INFORM-A-GRAM KEY NO. 1832

ON Dies EQUIPPED WITH
ELASTICONE GUIDE PIN COVERS



Day after day, year after year, manufacturers of ALL products are discovering how Elasticone Guide Pin Covers can work for them . . cutting die costs by eliminating the need for spare dies. Inexpensive Elasticones close the gap between pins and bushings, protecting dies against breakage . . protecting workers against injuries. Available in sizes to fit most pins and bushings.

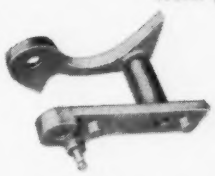
Write for complete literature and new Technical Bulletin 53

CENTRAL Safety Equipment Co.
6603 Marsden St. PHILADELPHIA 35, PA.

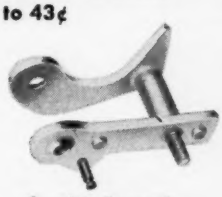
CIRCLE INFORM-A-GRAM KEY NO. 1833

SWITCH FROM INVESTMENT CASTING TO STAMPED ASSEMBLY SAVES 71%

Short-Run Blanking Dies Cut Unit Cost from $1.48 to 43¢



Investment Casting Cost:
$1.48 EACH IN 1000 LOTS



Complete Stamped Assembly Cost:
43¢ EACH IN 1000 LOTS

An investment casting was formerly used involving additional machining operations. Converting to a brass stamped assembly gave the customer a more accurate, physically superior part at a 71% saving.

Consider D-R Stampings for your products. Send sketch, blueprint or part, plus quantity, for prompt quotation.

DAYTON ROGERS *Manufacturing Company*
MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 1834

PERFORMANCE

• SMOOTH • POWERFUL
• DEPENDABLE

O-M

CYLINDERS
TIE-RODLESS

- *air and hydraulic*
- *meet JIC standards*

O-M Tie-rodless Air and Hydraulic Cylinders deliver peak performance at low or high speeds. They are simple and unique in design . . . have no tie rods or projecting end caps . . . fit easily in unusually close quarters . . . operate with lowest co-efficient of friction . . . and are readily disassembled for servicing. Besides, the ports can be oriented to any position. Interchangeable mounts make O-M Cylinders adaptable to any installation. All cylinders tested at rated operating pressures before shipment.

Available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods.

Write TODAY for BULLETIN 101A

MAIL COUPON NOW!

ORTMAN-MILLER MACHINE COMPANY
21 143rd Street, Hammond, Indiana
☐ Have Representative call
☐ Send Bulletin 101A (Round Line)
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Company_____
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CIRCLE INFORM-A-GRAM KEY NO. 1841

Over 85% of the torque wrenches used in industry are

STURTEVANT TORQUE WRENCHES
Read by Sight, Sound or Feel.

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
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- All Capacities

in inch grams...inch ounces...inch pounds ...foot pounds (All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

P.A. STURTEVANT CO.
ADDISON (QUALITY) ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1842

Empire
LIVE CENTERS
• ACCURATE • VERSATILE
• HEAVY DUTY

THE TAPERED SEAT ASSURES ACCURACY OF ±.0001

Manufactured in all tapers. 1 to 6 MT in stock. Special shanks and points made to order. PAT. PEND.

Points illustrated are standard.

Ask your Supplier or Write for Literature
ROYAL PRODUCTS
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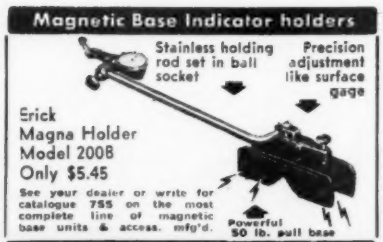
CIRCLE INFORM-A-GRAM KEY NO. 1843

Magnetic Base Indicator holders



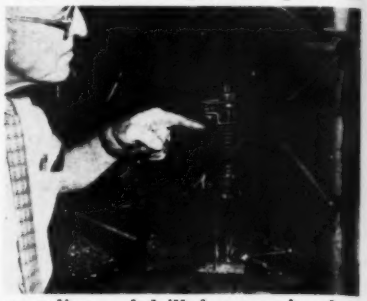
Erick
Magna Holder
Model 2008
Only $5.45

See your dealer or write for catalogue 755 on the most complete line of magnetic base units & access. mfg'd.

CULLEN MFG. CO., RACINE, WIS.

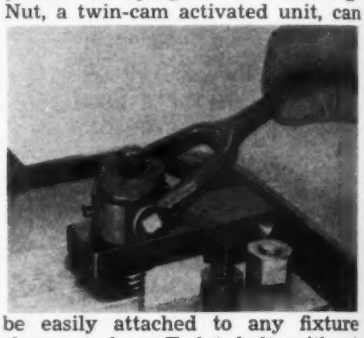
CIRCLE INFORM-A-GRAM KEY NO. 1844

Automatic Down Feed and Shut Off are provided by a new drill press attachment. The Automator automatically applies lighter pressure at the end of the stroke to prevent burring. Regulated pressure prevents



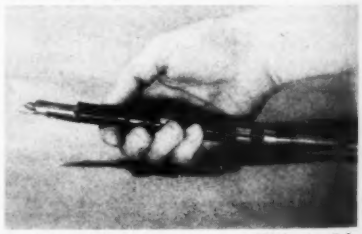
crowding and drill damage. An electric switch shuts off the drill when the hole is through or when stop is reached. Diamond Tool Co., Dept. T-1, Box 32, South Haven, Mich., or **Circle Inform-A-Gram No. A72.**

Increase Production through reduction of setup time in work-holding operations with a simple, inexpensive clamping device. The Jig-Nut, a twin-cam activated unit, can



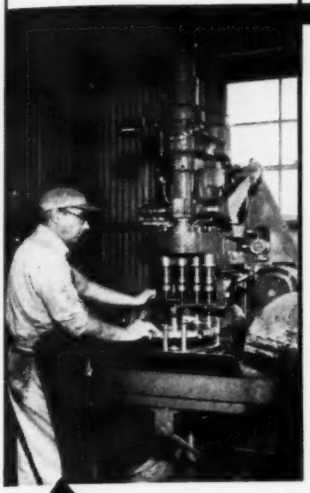
be easily attached to any fixture clamp stud or T-slot bolt without special fittings, air or hydraulic pressure lines. Morton Machine Works, P.O. Box 231, Millersburg, Pa., or— **Circle Inform-A-Gram No. A73.**

Ultrasonic Cutting Methods in the metals and ceramics fields are possible with a portable hand-type tool. The harder and more brittle the material to be cut, the faster the ultrasonic tool penetrates in the cutting



and machining process. This tool is effective only on extremely hard substances and harmless to anything resilient. For details on Model 200-A ultrasonic hand tool (shown), contact The Sheffield Corp., Dayton 1, O., or —
Circle Inform-A-Gram No. A74.

Thompson Products Inc. | West Coast Division



tapping production DOUBLED in pieces per hour with longer tool life

KAUFMAN

There's a good reason for that kind of a record. *Kaufman specializes in building tapping machines* . . . highly-precisioned machines designed for high production runs or for the versatile, multiple machine shop requirements. For complete information on how you can reduce production costs in your plant . . . send prints and samples of your work to

KAUFMAN MFG. CO.

529 S. 29th St. Manitowoc, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 1851

UNIVERSAL PARKSON GEAR TESTER FOR SPUR - WORM AND HELICAL & BEVEL GEARS

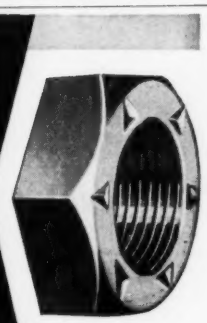
ABOVE PHOTO SHOWS SET-UP FOR WORM GEARS TO CHECK CENTER DISTANCE, CONTACT OF TEETH, RUNOUT, ETC.
CYLINDRICAL BUSHING
BETWEEN CENTERS
Scale and Vernier, Ease of adjustment, Convenient Features to hold Worm and Shaft on V-Blocks or Bushing.

PARKSONS ARE MADE IN SIZES
9" - 15" - 24/30" — PLAIN AND UNIVERSAL
ASK FOR DESCRIPTIVE ILLUSTRATED BULLETIN

GEO. SCHERR CO., INC.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-T LAFAYETTE ST. • NEW YORK 12, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1853

Use this THIN GRIPCO JAM NUT FOR
- Valve Handles
- Casters
- Shears
- Clippers
- Sickle Bars



or wherever you need a positive lock on short bolts where the strength of a full nut is not needed.

GRIPCO JAM NUTS come in the New Unified Finished and Heavy Series (Hexagon), in standard full and jam dimensions, in steel, brass and aluminum.

Gripco Products Include:

Gripco Lock Nuts • New Gripco "Clinch Nuts" Gripco Hi-Nuts • Gripco Pilot-Projection and Countersunk Weld Nuts
all with or without the famous Gripco positive locking feature. Also Standard Semi-Finish Nuts.

Write for samples and full particulars.

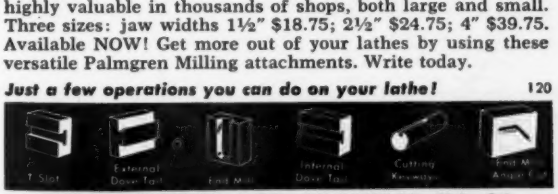
GRIP NUT COMPANY
107 Maple Ave. • South Whitley, Ind.

CIRCLE INFORM-A-GRAM KEY NO. 1852

NOW...you can CONVERT LATHES FOR MILLING in 10 seconds with the PALMGREN MILLING ATTACHMENT No. 250

Now, in your own shop, on your present lathes, you can do such jobs as Milling, Slotting, Grinding, Grooving, Sawing at angles, recessing and many more complicated jobs easily and quickly with the Palmgren Milling Attachment. Yes, in just 10 seconds you can convert to any of these operations and save time and money doing work you formerly had to send out. Precision built, graduated for rotary angle and vertical adjustments, easily mounted on all makes of lathes by straddling tool post, this attachment has proved highly valuable in thousands of shops, both large and small. Three sizes: jaw widths 1½" $18.75; 2½" $24.75; 4" $39.75. Available NOW! Get more out of your lathes by using these versatile Palmgren Milling attachments. Write today.

Just a few operations you can do on your lathe! 120



CHICAGO TOOL AND ENGINEERING CO.
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CIRCLE INFORM-A-GRAM KEY NO. 1854

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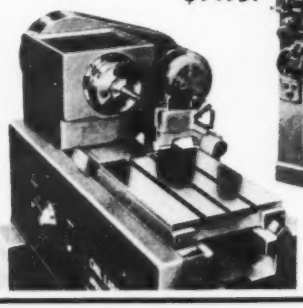
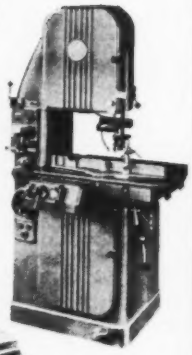
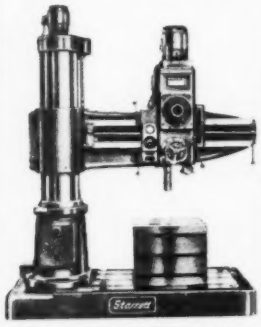
PRECISION BORING MACHINE
$2495.00

KOLLE K-16
Vertical Contour Metal Cutting Bandsaw.
$1495.





BEST VALUES IN U. S. A.
New Features—High Quality



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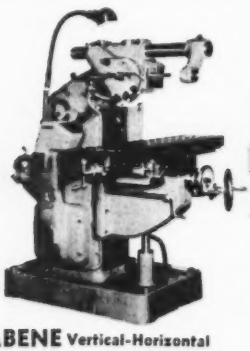
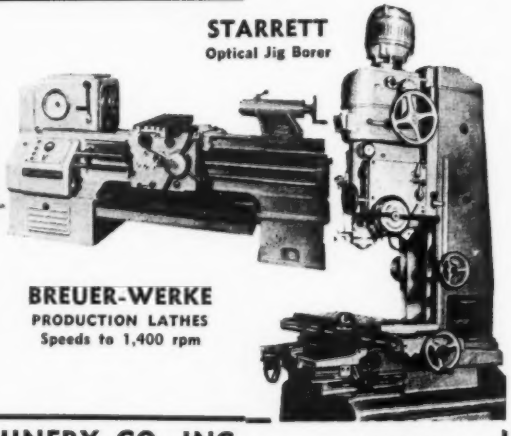
Sizes 2½' to 6'
$1769. to $6595.

Outstanding New Machinery AT LOWER COST!
$1.00 BUYS ANY MACHINE
Upon Termination of 3-Year Rental Plan

STARRETT
Optical Jig Borer





BREUER-WERKE
PRODUCTION LATHES
Speeds to 1,400 rpm

ABENE Vertical-Horizontal Milling Machine $3990.

AARON MACHINERY CO. INC.
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Branches at: Buffalo, N. Y.—Mineola, N. Y.—Los Angeles, Calif.
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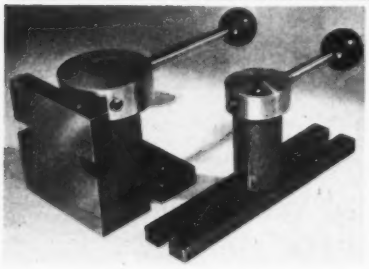

A Precision Production Holding Device

For drilling, tapping, milling, threading, reaming, etc., holding finished parts. Helpful on sub-assembly. Universally adaptable to drill presses, milling machines, surface grinders, tapping machines, etc. In 6 models, using 3C, 1A, 5C and 3AT Collets—capacity to 1", depending on Model. Price $29.50 to $62.50. Write for further information and name of Tool Supplier. Territories open for Suppliers.

ARROW MACHINISTS
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CIRCLE INFORM-A-GRAM KEY NO. 1862

THE HELIOS
50 EK VERNIER
CALIPER

6" SCALE HARDENED Guaranteed Accuracy within .001" Double Length Vernier

With Automatic Thumb Lock . . . With all Inch Scales or one Inch and one Metric Scale:
$9.90

The 55 A with set screw lock with one inch and one Metric scale or all Inch scales:
$8.90
All prices F.O.B. New York

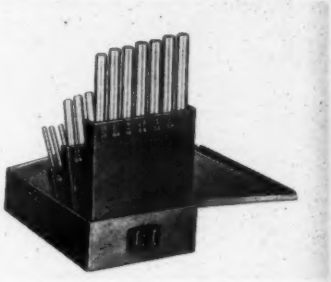
Also available . . . Dull Chrome finish calipers and Dial Indicator calipers.

For details on other imported precision instruments, write

NEISE MODERNTOOLS
KARL A. NEISE, Dept. TP
404 Fourth Avenue
New York 16, N. Y.

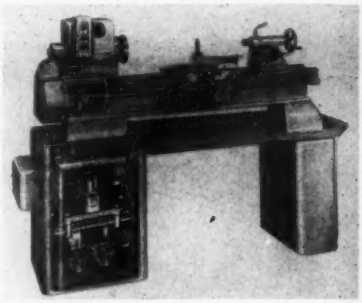
CIRCLE INFORM-A-GRAM KEY NO. 1863

A New Line of high precision drill and reamer blanks has been introduced by Lavallee & Ide, Inc., Chicopee, Mass. They are available in fractional sizes 1/16" through 1", wire gauge sizes No. 1 through No. 80, letter sizes A through Z, and in



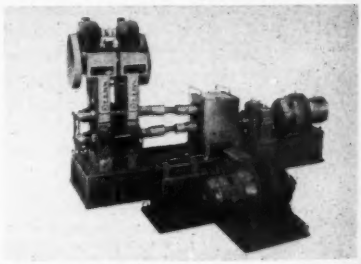
complete sets. These drill and reamer blanks are of the highest tolerances, requiring less machining and finishing time.
Circle Inform-A-Gram No. A75.

Heavy-Duty Variable Speed Drives are a feature of a new series of 11" and 13" swing lathes. They have high spindle speeds to permit infinite selection of speeds from 40 to 1800 rpm. A complete range of tool-



room and production accessories can be obtained for the lathes. Sheldon Machine Co., Inc., 4258 N. Knox Ave., Chicago 41, or —
Circle Inform-A-Gram No. A76.

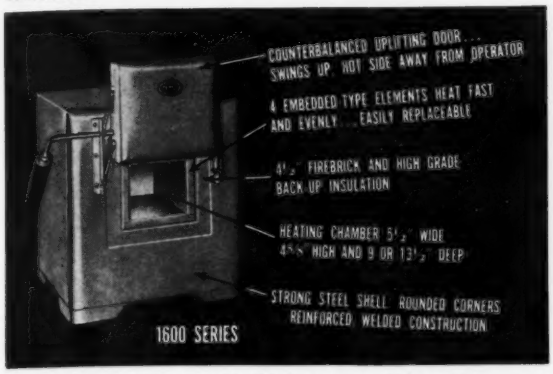
A Large Laboratory Rolling Mill has been added to the standard line of rolling mills produced by The Fenn Mfg. Co., Newington, Conn. Model 4-083 is capable of taking



heavy reduction on ferrous strip at all speeds between 100 and 500 fpm. It can be used as a two-high or four-high mill. The mill can be powered to take reduction up to 0.080" per pass on ferrous strip.
Circle Inform-A-Gram No. A77.

SAVE HOURS, CUT COSTS: Heat treat small parts, tools, dies, etc. in your own shop or plant with a versatile, highly efficient Temco Electric Furnace.

Why tie up your big equipment on small heat treat jobs below its capacity, or why "farm out" heat treating of parts, tools, dies? Put a TEMCO bench-type electric furnace in your shop and see how it pays for itself over and over again — in time savings, cost savings, and production conveniences.


COUNTERBALANCED UPLIFTING DOOR . . . SWINGS UP, NOT SIDE AWAY FROM OPERATOR
4 EMBEDDED TYPE ELEMENTS HEAT FAST AND EVENLY . . . EASILY REPLACEABLE
4½" FIREBRICK AND HIGH GRADE BACK UP INSULATION
HEATING CHAMBER 5½" WIDE 4⅝" HIGH AND 9 OR 13½" DEEP
STRONG STEEL SHELL ROUNDED CORNERS REINFORCED WELDED CONSTRUCTION
1600 SERIES

Temco Furnaces are economical to own and operate . . . easy to hook up . . . easy to use. Eight models with chamber sizes from 4" x 3¾" x 3¾" to 9½" x 8½" x 18". $65 to $600 complete with controls. Write for data and nearest dealer's name.

TEMCO **ELECTRIC FURNACES**
Thermo Electric Mfg. Co.
474 Huff Street, Dubuque, Iowa

CIRCLE INFORM-A-GRAM KEY NO. 1871

Expanding Mandrels

Accuracy 001" - No Distortion
No Slipping - Everlasting

K. O. LEE CO.
ABERDEEN, SOUTH DAKOTA

If it's made by **Lee** *it's a* **"Knock-Out"**

CIRCLE INFORM-A-GRAM KEY NO. 1872

METAL PRODUCTION CAPACITY AVAILABLE

For long or short production runs of large or small parts, tools, jigs or fixtures. Also dies, gages, special machinery.

KELLER PROFILOMETER-DUPLICATOR, 16" x 24"
PRESSES UP TO 450-TON, 48" x 48", TRIPLE ACTION
PLANERS UP TO 20-FOOT STROKE, 72" x 72"
RADIAL DRILL PRESSES UP TO 8-FOOT, 19" COLUMN
LATHES UP TO 158" c.c., 57½" gap, 40" SWING
BORING MILLS UP TO 120" BED, 90" HORIZ., 60" VERT.

Also Milling Machines, Grinders, etc. Complete production facilities — experienced machinists.

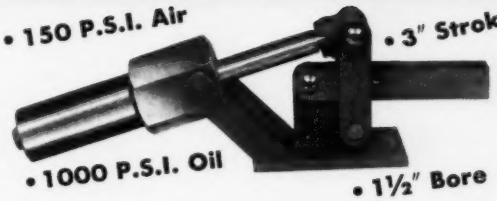
Eliminate Your Problems—Complete Design-and-Build Service

Inquiries Invited on Contract Basis or Individual Quotation

PIVOT PUNCH & DIE CORPORATION
NORTH TONAWANDA, N. Y. **Phone JA. 1200**

CIRCLE INFORM-A-GRAM KEY NO. 1873

TRIPLE-E Cylinder Clamps give you rugged construction longer operating life



HOOKS INTO EITHER AIR OR HYDRAULIC LINE
Operates on standard air line, or your hydraulic line.

COMPACT, RUGGED CLAMP CONSTRUCTION
All-welded bar stock insures strength. All pivot points are bushed with Merriman Broach Fit hardened bushings.

UNIQUE ADAPTER JOINS CYLINDER TO CLAMP
Prevents any deflection in clamp from being transmitted to the cylinder rod—for longer operating life.

CYLINDER IS COMPLETELY NON-CORROSIVE
End covers, tube and piston are made of brass—nickel plated for long wear and smooth action. All components oil-impervious. Hardened trunnion pins withstand wear.

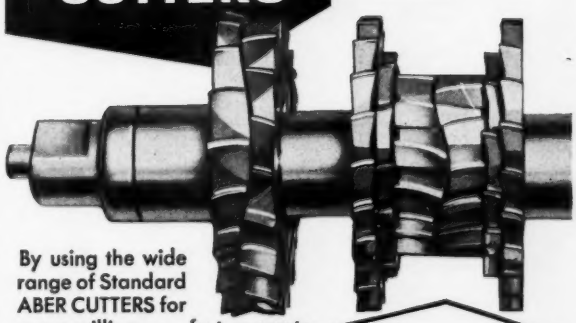
Write for Tracing Templates and detailed Catalog Sheets

E & E ENGINEERING, INC.
15023 Harper Avenue • Detroit 24, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1874

ABER *Curved Tooth* MULTIPLE CUTTERS

do unusual jobs unusually well



By using the wide range of Standard ABER CUTTERS for gang milling . . . fast accurate cuts on any number of surfaces simultaneously.

ABER Engineering service will design and make the unit exactly suited to your job . . . send blueprints and specify material to be cut.

ABER ENGINEERING WORKS
WATERFORD, WISCONSIN

ABER *Curved Tooth* PLUS FEATURES

1. Longer production runs
2. More accurate control of limits and finish
3. Elimination of chatter
4. Faster heat dissipation
5. Shearing action

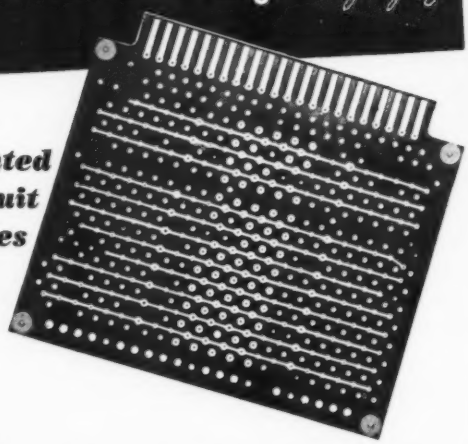
WRITE FOR FREE CATALOG

CIRCLE INFORM-A-GRAM KEY NO. 1875

TRACER-GUIDED DRILLING

100 HOLES P. M.

WITH NEW HERMES Engravograph



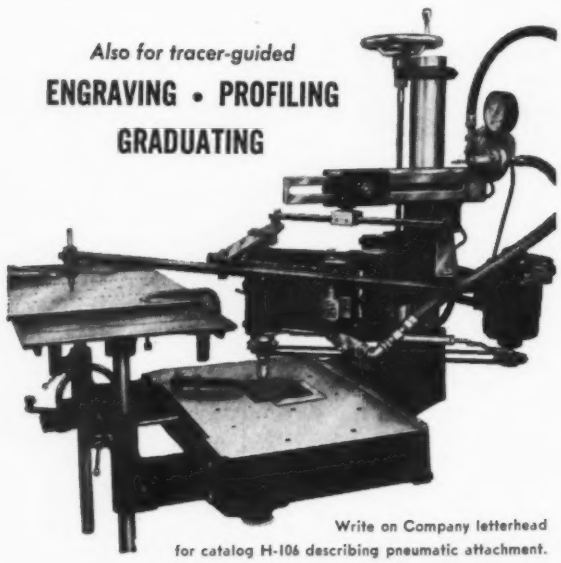
for printed circuit plates

- Pantograph reproduces drill pattern from template in any reduction ratio — assuring high accuracy.
- Allows drilling and routing of different size holes in one operation without changing tools.
- Pneumatic attachment with adjustable feed gives high speed production.

Also for tracer-guided

ENGRAVING • PROFILING

GRADUATING



Write on Company letterhead for catalog H-106 describing pneumatic attachment.

new hermes

ENGRAVING MACHINE CORP.

13-19 University Place, New York 3, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1881

try LAKESIDE for Heat Treating . . .

Our Services: Electronic Induction Hardening, Carbonitriding, Flame Hardening, Heat Treating, Bar Stock Treating and Straightening (mill lengths and sizes), Annealing, Stress Relieving, Normalizing, Pack, Gas or Liquid Carburizing, Nitriding, Speed Nitriding, Aerocasing, Chapmanizing, Cyaniding, Sand Blasting. Laboratory Physical Testing.

THE *Lakeside Steel Improvement Co.*

5418 LAKESIDE AVE., CLEVELAND 14, OHIO HENDERSON 1-9100

CIRCLE INFORM-A-GRAM KEY NO. 1882

After consultation with our engineering staff and with the use of dies from our tremendous library maintained specifically to save our customers time and money, this part illustrated actually saved one manufacturer 94% of usual production costs!

Price breakdown was as follows:

Tools	$89.00
Labor	.072
Material	.011

LOW die cost
FAST delivery

- Blanking
- Forming
- Piercing
- Drawing
- Extruding
- Stenciling
- Tapping
- Countersinking
- Plating
- Machining
- Painting
- Grinding
- Welding

Yes, WLS SPEEDTOOLING for small quantity stamping needs is a saver every time! A radical production advancement, it eliminates most of the cost required for permanent dies. Finished parts are produced to tolerances as close as those from tools costing ten times as much. When jobs are completed WLS SPEEDTOOLING is stored for future use.

Use WLS for production quantities up to 100,000 when low cost, fast delivery, possible design changes for virtually nothing, are important factors!

FREE

1. Write now for a free sample part with a cost summary.
2. Our free bulletin also illustrates 40 small stampings.
3. Send in your blueprints to our engineering department for a prompt quotation.

WLS **STAMPING COMPANY**

3283 E. 80th Street • Cleveland 4, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1883

At Your SERVICE

The largest contract welding facility west of Chicago, Electronic Welding Co., has been established in Burbank, Calif., under the management of George Palmer. Current projects include a Navy contract for the development of welding techniques, prototype and pilot run welded assemblies in connection with the R.A.T. missile program, and contracts to produce resistance welded assemblies for the Pratt & Whitney J-57 jet engine programs.

The Chicago Screw Co., division of Standard Screw Co., Bellwood, Ill., is offering complete services for the design, development and manufacture of screw machine products and cold upset parts. The company has available more than 1,100 machines capable of performing almost any secondary operation.

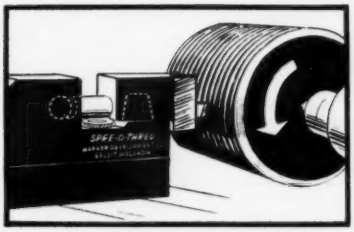
Metal stamping, fabricating, welding, phosphating, painting and assembly facilities for industry are found at The Bettcher Mfg. Corp. in Cleveland, Ohio. Major press equipment ranges from 20 to 650 tons, with maximum bed area of 50" x 124". The company produces parts for varying industries, such as the heating, aircraft and automotive.

A unique product producibility study and manufacturing cost analysis method is being offered by Engineering Service, Inc. of America, a Detroit firm. This method helps management accurately predict costs before making large capital expenditures. The company provides extensive tool, die and machine design; production engineering and product design and development services for industrial and metalworking plants.

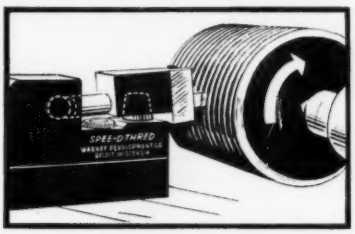
Injection molded tiny plastic parts are being produced by Gries Reproducer Corp. of New Rochelle, N. Y. The Gries' injection molding process is completely automatic and molds parts to precise tolerances and exacting specifications in one operation. Where parts are designed to incorporate threaded inserts, wires, metal stampings, tape, etc., this process permits them to be automatically inserted in the molding cycle either as individual inserts or continuous elements. The company molds all thermoplastics, with nylon a specialty.

Nylok-Detroit Corp., Birmingham, Mich., now has special automatic equipment designed to insert nylon pellets in any standard or threaded parts furnished to the company by a customer. The facilities are geared for handling both long and short run production requirements. The firm also manufactures complete, fully processed Nylock self-locking fasteners to customer specifications.

REDUCE THREADING COSTS BY HALF! (or more!)



CUTTING. Normal tool operation, with cutter accurately positioned by ball and cone, and held in position firmly by downward forces.



REVERSING. Tool releases on cone when forces are reversed, riding up and tipping freely to follow thread without marring or scratching (even on aluminum). Ball and cone are specially fitted to release freely yet reposition cutter as accurately as a solid holder.

SPEE-D-THRED
REVERSE-RIDING TOOL HOLDER

Single-point threading on an engine lathe can now be done in *half* (and less) of the usual time with the new SPEE-D-THRED tool. You simply *reverse the lathe* at the end of each cut. The tool rides free on the thread without scratching or marring on the return trip, then repositions accurately and solidly when the next cut starts.

NO WASTE TIME

During the return stroke you can set in the feed for the next cut without stopping the lathe. No need to back off the cross slide. No need to disengage the feed nut, lead screw stays in registration. No need to match an index mark. *You save all this time* and you cut scrap to the vanishing point!

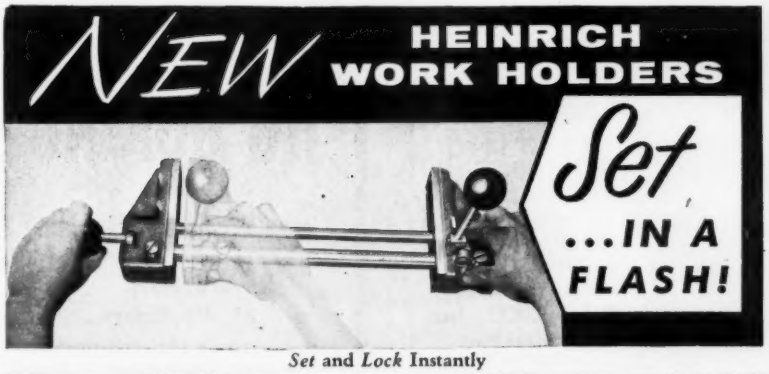
WRITE FOR LITERATURE

On your request we will send promptly detailed literature describing further valuable features of the operation of this remarkable tool. Ask for Bulletin ST 656.

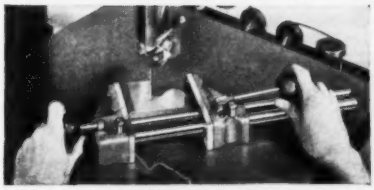
WARNER DEVELOPMENT CO.
BOX 33, SOUTH BELOIT, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 1891

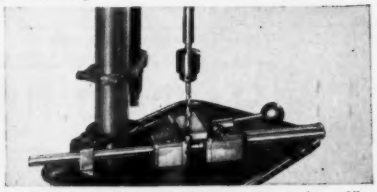
NEW **HEINRICH WORK HOLDERS**



Set and *Lock* Instantly



Heinrich Band Saw Vise. Capacity, 12½". Hands are clear for *safe* operation.



Heinrich Safety Drill Vise. Capacity, 6". Fits any style drill press.

New HEINRICH Grip-Master Work Holders set and lock instantly. Band Saw Vise has removable shoulder screws for automatic chain feed operation. Safety Drill Vise with table mounting attachment leaves operator's hands free . . . safely secures vise . . . eliminates danger of unit spinning or breaking loose.

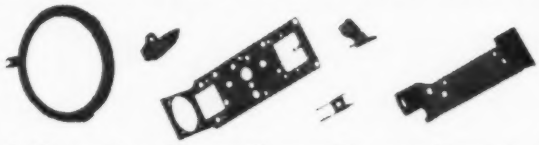
Write for FREE Catalog

"Circle-Grip" locking mechanism used in Grip-Master Vises is also used in HEINRICH Work Holders.

HEINRICH TOOLS, Inc., Dept. 136-M Racine, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 1892

STAMPINGS - - - SHORT RUNS



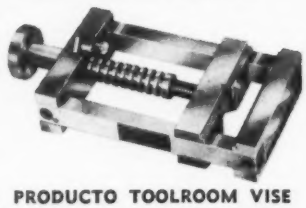
A dependable service for small quantity requirements for new developments and production up to 50,000 pieces. QUICK DELIVERY — ACCURACY — backed by 25 years' experience.

SMALL LOT STAMPING CO.

Linden 3-3700 "Dedicated to Short Runs" 1025 W. Blancke St. Linden, New Jersey

CIRCLE INFORM-A-GRAM KEY NO. 1901

ESSENTIAL



PRODUCTO TOOLROOM VISE

Producto's Precision Toolroom Vise is essential equipment for your jig borers, surface grinders, drill presses, tappers. It's extremely strong, yet weighs only 13 lbs. and has a 2" high frame. Has large jaw opening, will clamp heavy as well as light workpieces. All surfaces hardened and ground. Works on five surfaces. Write for Bulletin TE2-103.

THE PRODUCTO MACHINE CO.
970 Housatonic Avenue
Bridgeport 1, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 1902

Star Stainless screws have clean—bright and—shiny—heads

STAR STAINLESS SCREW CO.

CORROSION RESISTANT

679 Union Blvd., Paterson 2, N. J.
Telephone: Little Falls 4-2300
Direct New York Tele. WI 7-9041

CIRCLE INFORM-A-GRAM KEY NO. 1903

HARDNESS TESTING

has been done with the **SCLEROSCOPE**
Since 1907

•

THE SHORE INSTRUMENT & MFG. CO., Inc.
90-35 Van Wyck Expressway
Jamaica 35, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1904

JIG BORING
and
Large Precision Machining
Done to your specifications
We Have
21 Jig Borers

KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1905

STANDARD FLUSH PIN GAGES

Precision Built
of Precision Ground
Oil Hardened
Tool Steel

Can be Furnished with Indicator Mountings
Completely Ground to Your Specifications and Ready for Use
No Design Necessary
Deliverable from Stock

Write for Latest Catalog as well as our Automatic Free Service.
Representatives Wanted for Most Industrial Areas

UNION GAGE CORP.
711 Lehigh Avenue Tel. Murdock 6-9150 UNION, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1906

THROW-AWAY BUTTON INSERTS INCREASE ARMOR MACHINING

The turning, facing and boring of the 38½" dia pieces of cast armor shown in the illustration, were considered too much for standard brazed carbide tools, at least when compared with the performance of indexable inserts of Kendex, "throw-away" button inserts.

These armor parts have a Brinell hardness of 280 to 300 except in some chilled spots that are still harder. Furthermore the bottom of the bore

requires severe interrupted cutting. With standard brazed carbide tools only 1-pc/tool grind could be machined on roughing and 3-pcs/grind on finishing cuts.

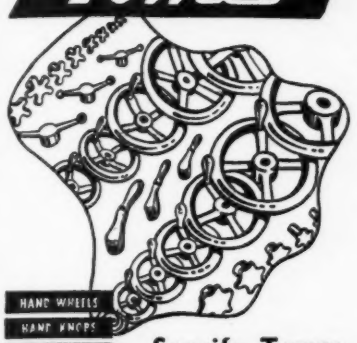
A 100% improvement was made by changing to heavy-duty Kendex indexable insert tooling—made by Kennametal Inc., Latrobe, Pa.—using two 54" Bullard Cutmasters. Depth of roughing cut is ¼" to 7/16" with feed of 0.015" at 270 sfpm.

For roughing the face and shoulder, a style KBR-24 tool with rectangular insert is used. Since this insert has four cutting edges, eight pieces are machined before discarding. Grinding was eliminated.

Outside diameter is rough turned with a style KFL-24 tool and boring is done with a style KFR-24 tool. Parallelogram inserts permit the use of four cutting edges, each of which is good for machining two pieces.

Finishing operations are done with parallelogram inserts and style KAR-24 tool. Since less strength of cutting material is required for finishing, the harder grade K4H inserts are used instead of K2S which was used for roughing cuts. Six pieces are finish machined per cutting edge for a total of 12 pieces with this tool and 24 pieces with each of the other finishing tools. Depth of the finishing cut is 1/32" with feed of 0.015" at 250 sfpm.

Tomco



Specify Tomco for long lasting dependability

A complete line of high grade hand knobs, handles, and hand wheels is available from Tomco. Immediate shipments are made from stock of standard items. Specialty items are made to your specifications.

For original equipment or replacement parts look to Tomco for quality and service.

Write for literature

Tomco PRODUCTS CO.
1623 DOUGLAS AVE.
RACINE, WISCONSIN

Blank or Machined—from stock

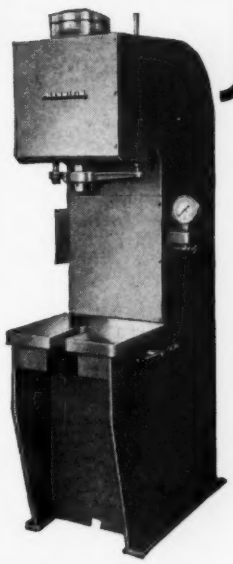
CIRCLE INFORM-A-GRAM KEY NO. 1911

PRICE LIST

ON HANNIFIN STOCK HYDRAULIC PRESSES

1-TON, Bench Type	$ 605
2-TON, Bench Type	$ 680
5-TON, with Base	$1,530
8-TON, with Base	$1,605
10-TON, Floor Type	$2,290
25-TON, Floor Type	$3,790

Prices complete with motors and starters F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



DELIVERY FROM STOCK

Demand for these popular presses is so consistent we are able to produce them in quantity and pass the savings along to you.

Construction-wise and quality-wise these small general-purpose presses are identical to the larger Hannifin presses, up to 150 tons. Special, optional controls when needed.

WRITE for complete information on the Hannifin Hydraulic Press you're interested in.

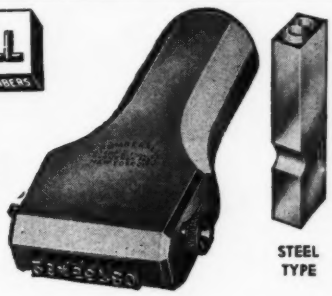
HANNIFIN

HANNIFIN CORPORATION, 563 S. WOLF ROAD, DES PLAINES, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1912

NUMBERALL
CUTS THE COST OF STAMPING NUMBERS

IMPROVED TYPE HOLDERS for stamping into Metal, etc.

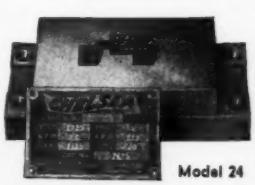


STEEL TYPE

Hand or Press Style. Type can be easily, quickly loaded and unloaded. Simplest construction . . . just a sturdy pin holds the type securely. No screws nor springs. Super-quality steel type made in various sizes: 1/32" up to ½" figures and letters. Write for Bulletin TP23H.

DETAIL CHASE and PUNCH

FOR QUICK STAMPING OF NAMEPLATES



Model 24

An ingenious tool for rapid stamping of plain, etched or embossed name plates. Used in a small Kick or Power Press, or in our No. 93 or No. 131 Bench Press. Steel Type and Logo Type are dropped into recess. Logo Type are used for numerical and letter combinations.

All lines are stamped in one operation, making tool very efficient. Small, as well as large lots can be stamped economically, neatly. Write for Bulletin TP-24.

NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1913

SETTING
PRODUCTION RECORDS
for large hole tapping!

New heavy duty
"TAP KING"

You'll marvel at the speed, power and precision at your fingertips when you operate this remarkable tapping unit. Designed for large hole, heavy duty tapping, it has repeatedly demonstrated its superiority on many difficult jobs. Here are just a few samples: "on open hole tapping in carbon steel forgings—production increased 50%"—"on blind tappings in steel castings—production up 100%"—"Tapping in 1½" steel plate—a class 2 fit was maintained with ease". The Tap King assures you better finished parts, less spoilage, fewer broken taps, faster, easier operation and greater production. Learn how you can improve your tapping with a TAP KING.

Write for FREE Brochure
giving you full details and specifications on this amazing unit.

PROCUNIER SAFETY CHUCK COMPANY
12-14 S. Clinton St., Dept. 12 Chicago 6, Ill.

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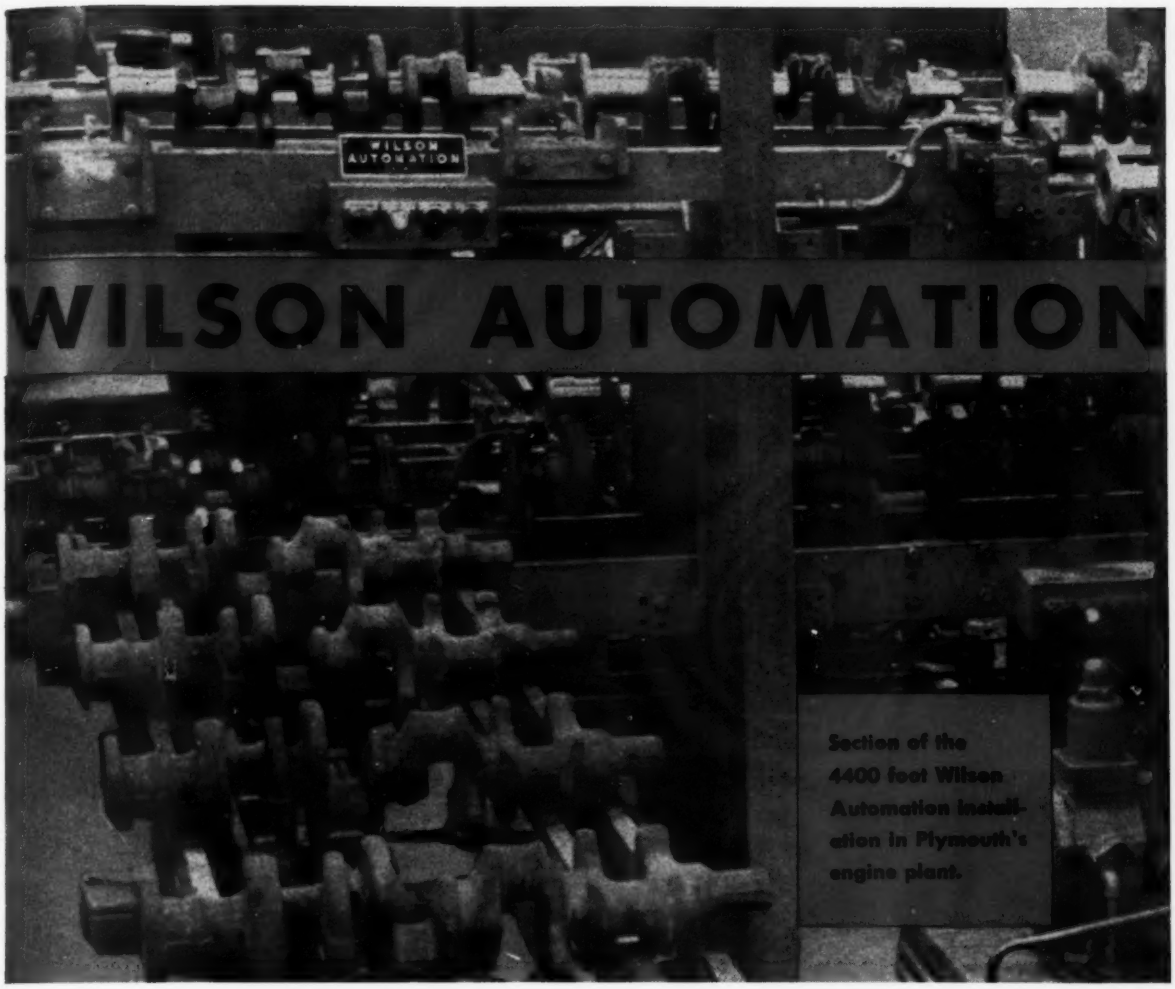
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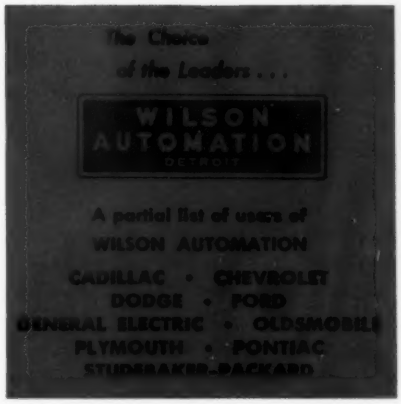

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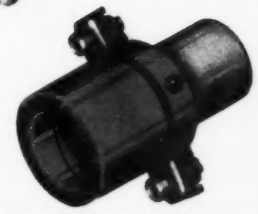

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